Audit Report

OFFICE OF THE INSPECTOR GENERAL

LOW-RATE INITIAL PRODUCTION IN MAJOR DEFENSE ACQUISITION PROGRAMS

Report No. 94-014

November 9, 1993

This special version of the report has been revised to omit predecisional data.

Department of Defense

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Acronyms

AFOTEC	Air Force Operational Test and Evaluation Center
ASPJ	Airbourne Self-Protection Jammer
CDR	Critical Design Review
EMD	Engineering and Manufacturing Development
GAO	General Accounting Office
IOT&E	Initial Operational Test and Evaluation
JTIDS	Joint Tactical Information Distribution System
LRIP	Low-Rate Initial Production
MILSTAR	Military Strategic and Tactical Relay Satellite
OPTEVFOR	Operational Test and Evaluation Force
OSD	Office of the Secretary of Defense
PLS	Palletized Load System
PRR	Production Readiness Review
SFW	Sensor Fuzed Weapon
TRR	Test Readiness Review
USD(A)	Under Secretary of Defense for Acquisition

INSPECTOR GENERAL
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November 9, 1993

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION

SUBJECT: Audit Report on Low-Rate Initial Production in Major Defense Acquisition Programs (Report No. 94-014)

We are providing this final report for your information and use. This report addresses the effectiveness of DoD's use of Low-Rate Initial Production in major Defense acquisition programs. Management comments were considered in preparing the final report and are in Part IV, Management Comments.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. Therefore, we request that the Under Secretary of Defense for Acquisition provide comments on the unresolved recommendations by January 10, 1994. If you concur, describe the corrective actions taken or planned, the completion dates for actions already taken, and the estimated dates for completion of planned actions. If you nonconcur, state your specific reasons for each nonconcurrence. If appropriate, you may propose alternative methods for achieving desired improvements. The recommendations are subject to resolution in accordance with DoD Directive 7650.3 in the event of nonconcurrence or failure to comment. We also ask that your comments include concurrence or nonconcurrence with the material internal control weaknesses highlighted in Part I. This report identifies no quantifiable monetary benefits.

We appreciate the courtesies extended to our audit staff. If you have any questions on this report, please contact Mr. Russell A. Rau, Program Director, at (703) 693-0186 (DSN 223-0186) or Mr. Harold C. James, Project Manager, at (703) 614-3974. Copies of the final report will be distributed to the organizations listed in Appendix K.

Robert J. Lieberman
Assistant Inspector General
for Auditing

This special version of the report has been revised to omit predecisional data.

Office of the Inspector General, DoD

Report No. 94-014
(Project No. 2AE-0026)

November 9, 1993

LOW-RATE INITIAL PRODUCTION IN MAJOR DEFENSE ACQUISITION PROGRAMS

EXECUTIVE SUMMARY

Introduction. Low-Rate Initial Production (LRIP) is defined as the production of a system in limited quantity to provide articles for operational test and evaluation, to establish an initial production base, and to permit an orderly increase in the production rate sufficient to lead to full-rate production upon completion of operational testing. Planning for LRIP begins early in the acquisition process. Proposed LRIP quantities are determined during Phase I, Demonstration and Validation. Milestone decision authorities then set the LRIP quantity at the Milestone II, Development Approval. The design, testing, and production preparation efforts necessary to support entry into LRIP are presently part of Phase II, Engineering and Manufacturing Development.

Objectives. The primary objective of the audit was to evaluate the effectiveness of DoD's use of the LRIP in major Defense acquisition programs. We also evaluated compliance with the internal controls associated with the LRIP process.

Audit Results. LRIP was not being used effectively to manage program risks inherent in both the entry into LRIP and the transition from LRIP to full-rate production.

o All seven of the major Defense acquisition programs reviewed entered LRIP without completing at least some prerequisites in design, testing, and preparation for production. Premature entry into LRIP was caused by inadequacies in the milestone review process, regulations, and policy guidance for LRIP. As a result, DoD incurred unwarranted program risk due to excessive program concurrency (Finding A).

o LRIP acquisition strategies did not effectively limit production quantities before Milestone III, Production Approval. As a result, the Government incurred the excessive program risk of over-commitment to production of systems that have not proved their technical or operational suitability or production readiness and that may have deficiencies that are costly and difficult to fix on delivered and accepted units (Finding B).

Internal Controls. The audit identified material internal control weaknesses. Finding A shows that Department of Defense directives, instructions, and standards provided for only limited guidance and oversight regarding transition from development to LRIP. Finding B identified that increased Office of the Secretary of Defense and Military Department oversight was needed to ensure that LRIP quantities were limited to the minimum necessary for testing and production base purposes. This oversight will ensure that all prerequisites are met before making the low-rate production decision. These internal control weaknesses are discussed in Part I of this report.

Potential Benefits of the Audit. Implementing the recommendations in this report will ensure that decisions to enter and continue LRIP production are made when fully supported by risk assessments based upon testing, design, and production accomplishments. Further, LRIP quantities will be limited to the minimum necessary

to provide production units for operational test and evaluation, to establish a production base, and to transition to full-rate production. Monetary benefits to be realized by implementing the recommendations were not readily quantifiable because the recommendations will affect an undeterminable number of future programs transitioning to LRIP and to full-rate production. Appendix I notes the potential benefits to be derived from implementing the recommendations.

Summary of Recommendations. We recommend that the Under Secretary of Defense for Acquisition revise acquisition regulations and military standards to provide additional internal controls for assessing the readiness of programs to enter LRIP, including a required milestone review before entry into LRIP, and to limit the number of LRIP units produced to the minimum quantity necessary to support Initial Operational Test and Evaluation and production base considerations.

Management Comments. Management comments to the draft report were provided for the Under Secretary of Defense for Acquisition by the Director, Acquisition Program Integration. The Director partially concurred with our findings and recommendations. A full discussion of management comments and audit responses is in Part II, and the complete texts of the Director's comments as well as additional comments submitted by the Office of the Deputy Assistant Secretary of the Air Force (Acquisition) and the Office of the Army Director for Combat Service Support are in Part IV of this report. We request that the Director reconsider his position on noncurrences and provide additional comments to the final report by January 10, 1994.

Table of Contents

Executive Summary i

Part I - Introduction

Background 2
Objectives 3
Scope 4
Internal Controls 5
Prior Audits and Other Reviews 6

Part II - Finding and Recommendations

Finding A. Readiness for Low-Rate Initial Production 8
Finding B. Low-Rate Initial Production Quantities and Commitments 32

Part III - Additional Information

Appendix A. Statutes Related to Low-Rate Initial Production 42
Appendix B. Low-Rate Initial Production Guidance 47
Appendix C. Prior Audits and Other Reviews 51
Appendix D. Inspector General, DoD, Reports and Memorandum Issued as a Result of This Audit 55
Appendix E. Summary of Program Deficiencies in the Transition to Low-Rate Initial Production 57
Appendix F. Proposed Low-Rate Initial Production Milestone Documentation Requirements 59
Appendix G. Multiple Annual Low-Rate Initial Production Contracts Awarded or Planned 60
Appendix H. Low-Rate Initial Production as a Percentage of Total Planned Production 61
Appendix I. Summary of Potential Benefits Resulting From Audit 62
Appendix J. Organizations Visited or Contacted 64
Appendix K. Report Distribution 66

Part IV - Management Comments

Department of the Air Force Comments 70
Department of the Army Comments 73
Office of the Under Secretary of Defense Comments 76

This report was prepared by the Acquisition Management Directorate, Office of the Inspector for Auditing, DoD. Copies of the report can be obtained from the Secondary Reports Distribution Unit, Audit Planning and Technical Support Directorate (703) 614-6303 (DSN 224-6303)

Part I - Introduction

Background

Low-Rate Initial Production (LRIP), as defined by DoD Instruction 5000.2, "Defense Acquisition Policies and Procedures," February 23, 1991, is the production of a system in a limited quantity to:

o Provide articles for operational test and evaluation,

o Establish an initial production base, and

o Permit an orderly increase in the production rate so that full-rate production will start after successful completion of operational testing.

The purpose of LRIP is to verify the adequacy of the manufacturing or production process, confirm the stability and producibility of the design, produce units for operational test and evaluation of system capabilities, and provide information to support Production and System Configuration Baselines.

Planning for LRIP should begin early in the acquisition process. DoD Instruction 5000.2 requires that proposed LRIP quantities be determined during Phase I, Demonstration and Validation, and that milestone decision authorities approve the LRIP quantity at the Milestone II, Development Approval, decision point. The design, testing, and production preparation necessary to support entry into LRIP are then done as part of the Phase II, Engineering and Manufacturing Development (EMD), effort. Presently, LRIP is part of the EMD phase of the acquisition process leading to Milestone III, Production Approval, for the start of production and deployment. Before the revised 5000 series acquisition regulations were issued in February 1991, LRIP was frequently a separate milestone decision point, designated Milestone IIIA. No formal DoD requirement existed to conduct an LRIP milestone review.

DoD guidance for transitioning from development to LRIP to full-rate production is provided by several sources:

o Various statutes address LRIP and operational testing requirements as discussed in Appendix A. Of particular note, United States Code, title 10, section 2399 provides that a major Defense acquisition program may not proceed beyond LRIP until Initial Operational Test and Evaluation (IOT&E) is completed; and the DoD Director of Operational Test and Evaluation reports to Congress that test and evaluation were adequate and that the results of test and evaluation confirm that the items or components tested were effective and suitable for combat.

o DoD Instruction 5000.2 requires that program acquisition strategies be event-driven, with entry into LRIP and full-rate production based on accomplishing specific program results, known as exit criteria.

o DoD 4245.7-M, "Transition from Development to Production," issued in September 1985, provides guidance on minimizing risks associated with transitioning from full-scale development to production through timely accomplishment of prerequisites in design, testing, and production readiness.

o Military Standard 1521-B, "Technical Reviews and Audits for Systems, Equipments, and Computer Software," June 4, 1985, identifies technical reviews and audits required of acquisition programs at various stages. As systems are developed, these reviews and audits provide feedback concerning the suitability of system hardware and software design and the risks associated with production decisions. Additional DoD guidance concerning LRIP is in Appendix B.

The effective planning and execution of the LRIP process is essential for a smooth transition to economical full-rate production of systems that will meet the mission requirements of planned system users.

DoD has defined "concurrency" in acquisition strategies as the degree of overlap between the development and production processes of an acquisition program. Concurrency is most prevalent during LRIP where engineering and manufacturing development activities continue during initial production. The DoD rationale for high concurrency includes providing earlier operational capability when the need is time-urgent, avoiding technical obsolescence, and attaining efficiencies by maintaining the production process and work force. DoD has also recognized that low concurrency provides for greater design maturity that increases the likelihood of meeting system requirements and avoiding retrofit costs to make production articles work properly.

The 1986 report of the President's Blue Ribbon Commission on Defense Management (the Packard Commission named after Chairman David Packard) and the subsequent 1989 Defense Management Report by the Secretary of Defense emphasized testing prototype hardware to reduce concurrency between development and production. In April 1990, the Under Secretary of Defense for Acquisition (USD[A]) issued a report to Congress, giving a detailed assessment of concurrency and associated program risk. In May 1992, the USD(A) stated that, as a result of the break up of the Warsaw Pact and dissolution of the Soviet Union, DoD should reduce concurrency in development programs. The USD(A) stated specifically that less risk would be accepted in acquisition programs than had been accepted in the past.

Objectives

Our overall objective was to evaluate the effectiveness of DoD use of LRIP for major Defense acquisition programs. An additional objective was to evaluate the internal management controls associated with the LRIP process. The audit is one of a series of reviews to assess implementation of recommendations in the Secretary of Defense's "Defense Management Report."

Scope

To satisfy our objectives, we examined four major Defense acquisition programs that either were in LRIP or scheduled to enter LRIP before January 1993. These programs were judgmentally selected from the universe of programs meeting the criteria for major Defense acquisition programs established in DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures." Programs included one each from the Army and Air Force and two from the Navy:

- Army:

  Palletized Load System (PLS)

- Navy:

  MK-50 Torpedo System

  EA-6B Aircraft System

- Air Force:

  Military Strategic and Tactical Relay Satellite Terminal (MILSTAR) Program

The audit was performed between April 1992 and January 1993 and included a review of LRIP data and information from 1983 to January 1993. Our examination resulted in an assessment of criteria established for initial and follow-on LRIP decisions in program acquisition strategies and compliance with these criteria. We also assessed support for identified LRIP quantities and decision schedules, the approval process for LRIP decisions and contract awards, proper utilization of development and production funding, support for proceeding to full-rate production, and corrective actions on related LRIP findings in prior audits.

We examined information and data in acquisition plans, operational requirements documents, contract files, test and evaluation master plans, developmental and operational test reports, and technical reviews and audits performed to support progress toward LRIP or full-rate production. We interviewed personnel responsible for program management, procurement, testing, and contract administration, as well as Defense plant representatives and contractor personnel to determine and evaluate the policies and procedures followed in the LRIP process. We also examined the LRIP information given to senior acquisition management in the "Defense Acquisition Executive Summary" and other reports.

To supplement our audit coverage, we also identified LRIP-related issues included in Inspector General, DoD, and General Accounting Office (GAO) reports on four additional systems. These systems included the Navy's

Airborne Self-Protection Jammer (ASPJ) and the Air Force's C-17 Aircraft, Sensor Fused Weapon (SFW) System, and Joint Tactical Information Distribution System (JTIDS). Appendix C provides a synopsis of these reports.

This program results audit was made in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD, and included necessary tests of internal controls. Appendix J lists activities visited or contacted.

Internal Controls

We evaluated the adequacy of internal controls over the LRIP process. As part of our evaluation, we assessed:

o Statutory and DoD regulatory guidance on the LRIP process;

o Military Department implementing procedures and compliance with regulations; and

o Oversight of the LRIP process by the Office of the Secretary of Defense (OSD) and the DoD Components.

The audit identified material internal control weaknesses, as defined by Public Law 97-255, Office of Management and Budget Circular A-123, and DoD Directive 5010.38. OSD and Military Department guidance and oversight for the LRIP process were not adequate to ensure that major Defense acquisition programs completed the prerequisites in design, testing, and preparation for production necessary to reduce risk when transitioning into LRIP. Additionally, increased OSD and Military Department oversight was needed to ensure that LRIP units were limited to the minimum quantities required for testing and production purposes and to ensure that all prerequisites were met before making full-rate production and deployment decisions.

Implementation of the recommendations for Findings A and B will correct these weaknesses. The monetary benefits of implementing these recommendations were not readily quantifiable because the recommendations will affect an undeterminable number of future programs transitioning to LRIP and to full-rate production. A copy of the report is provided to senior officials responsible for internal controls in the Office of the Secretary of Defense and the Military Departments.

Prior Audits and Other Reviews

Since 1989, the Inspector General, DoD, had issued eight reports and the GAO had issued six reports addressing issues related to low-rate initial production. These reports are synopsized in Appendix C. During the course of this audit, we issued reports on the Navy EA-6B Aircraft Remanufacture and Air Force MILSTAR Terminal programs, as well as a memorandum to the USD(A) on the Army PLS. Our reports and memorandum addressed time-sensitive concerns relating to program readiness for upcoming production decisions. Appendix D synopsizes these reports.

Part II - Findings and Recommendations

Finding A. Readiness for Low-Rate Initial Production

All seven of the major Defense acquisition programs reviewed entered LRIP without completing at least some prerequisites in design, testing, and preparation for production. Premature entry into LRIP was caused by inadequacies in the milestone review process, regulations, and policy guidance for LRIP. Also, program planning was done when urgency to meet threats justified highly concurrent development and production efforts. As a result, the Government incurred significant program risk from systems entering LRIP when their designs were not stable and the readiness of production processes was not verified.

Background

Three critical decision points preceed entry into LRIP:

o the Milestone II, Development Approval, which approves the program acquisition strategy of LRIP and LRIP quantities;

o LRIP long-lead funding approval; and

o LRIP approval.

At the Milestone II decision point, DoD Instruction 5000.2 requires that the Director, Operational Test and Evaluation, determines the quantities of LRIP articles required for operational testing of a Major Defense Acquisition Program. Additionally, Change 1 to DoD Instruction 5000.2, dated February 26, 1993, states that authority to proceed with LRIP may require a separate program review and milestone decision authority approval at a point specified in the Milestone II decision. However, DoD Instruction 5000.2 does not contain direction on determining the LRIP quantities to be produced and exit criteria for entry into LRIP and subsequent LRIP production lots. Considerations in determining LRIP quantities are only provided for Naval vessels and satellites, which can have unique total quantities and production periods. These considerations include complexity of the system, total number to be procured, length of the production period, industrial-base implications, and acquisition strategy most advantageous to the Government.

Obligation of long-lead funding to support entry into LRIP is the second critical decision point associated with LRIP. The long-lead funding decision point represents the commitment of funds to initiate production-related activities. The April 1990 USD(A) report to Congress on concurrency guidelines proposed that clear exit criteria be established for initiation of long-lead funding for LRIP and that the decision to commit funds be supported by operational test assessments. However, DoD Instruction 5000.2 and other acquisition guidance do not establish policy for the commitment of long-lead funding for LRIP.

The third critical decision point associated with LRIP is the approval of entry into LRIP. As stated, the 1993 change to DoD Instruction 5000.2 suggests, but does not require, a program review and milestone decision-authority approval of proceeding into LRIP. The new guidance in DoD Instruction 5000.2 also suggests that exit criteria be established that, when successfully passed, allow the program office to expand activities or commitments during an acquisition phase. Long-lead procurement funding and LRIP are examples of such commitments. Finally, the new guidance states that additional activities or program reviews are triggered by failure to meet exit criteria established for proceeding into LRIP.

In summary, LRIP is a critical element in the acquisition strategy for a weapon system. LRIP allows the contractor to start the system production line concurrently with ongoing engineering development. Therefore, the acquisition strategy, implementing acquisition plan, and acquisition management process should ensure that the decision to begin LRIP is based upon demonstrated technical and performance accomplishments, not schedule or fiscal considerations. DoD has emphasized the use of event-driven acquisition strategies so program prerequisites are accomplished timely and in the appropriate sequence.

Initiative to Reduce Program Risk. On April 17, 1990, the USD(A) issued the "Report on Guidelines for Determining the Degree of Risk Appropriate for the Development of Major Defense Acquisition Systems, and Assessing the Degree of Risk Associated with Various Degrees of Concurrency; and Concurrency in Major Acquisition Programs." This report responded to Section 801 of the National Defense Authorization Act for Fiscal Years 1990 and 1991, which required establishing guidelines for:

o Determining the degree of concurrency that is appropriate for the development of major Defense acquisition systems; and

o Assessing the degree of risk associated with degrees of concurrency.

The 1990 report provided guidelines for assessing concurrency and risk and proposed that these guidelines be in the revision to the DoD Directive 5000.1, "Major and Non-Major Acquisition Programs," later issued in February 1991. The proposed guidelines were to help establish acquisition strategies for acquisition programs that explicitly link milestone decisions to demonstrated accomplishments. The guidelines specific to the LRIP decision included:

o Ensuring that the acquisition strategy will provide confidence that a stable design exists before the program moves into LRIP (LRIP validates the production process and the design must be stable at this point);

o Establishing clear exit criteria for initiation of long-lead funding for LRIP and for entry into LRIP;

o Ensuring that all development testing is properly time-phased so technical problems are highlighted before they become critical; and

o Ensuring that engineering development articles, which usually will be used to perform the testing upon which initial production decisions will be made, are representative of the production configuration.

In addition to providing specific guidelines for the LRIP decision, the report proposed that program concurrency risk be reduced through "aggressive" use of prototyping and testing to identify and remedy problems well before production starts. The Packard Commission was cited as the source for this proposal. We are separately evaluating the use of prototyping in our "Audit of DoD Use of Prototyping Acquisition Strategies for Major Defense Acquisition Programs" (Project No. 2AE-0051).

Revision of DoD Guidance. When the revised DoD Directive 5000.1 and the implementing DoD Instruction 5000.2 were issued in February 1991, the guidance for LRIP was very general. The revisions did not include the specific LRIP-related guidance as proposed in the April 1990 report.

In addition to proposing concurrency guidelines, the USD(A) report defined three levels of program concurrency:

o Low - Program will have completed essentially all IOT&E before entering production (either LRIP or beyond LRIP);

o Moderate - Program proceeds into LRIP with only part of the early IOT&E completed; and

o High - Programs proceeds into LRIP before significant IOT&E is completed.

Based on the results of our review of program test accomplishment before LRIP, we believe all eight programs we reviewed involved moderate or high levels of concurrency.

Planning and Preparation for Low-Rate Initial Production

The planning and preparation for LRIP decisions did not provide for fulfilling the design, testing, and production preparation prerequisites established under DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures"; Military Standard 1521-B, "Technical Reviews and Audits for Systems, Equipments, and Computer Software"; and DoD 4245.7-M, "Transition from Development to Production," for transition into LRIP. Shortfalls in program accomplishment and documentation in design, testing, and manufacturing areas critical to support entry into LRIP included:

o Essential testing, assessments, and technical reviews not performed;

o Significant problems, identified in testing or technical reviews, scheduled for resolution after entry into LRIP decision;

o Documentation from technical reviews and from developmental, reliability, and operational testing, not planned to be available to support scheduled LRIP decisions.

Appendix E summarizes the LRIP deficiencies for seven of the eight major Defense acquisition programs included in this audit. Discussion concerning the eighth system, the Air Force SFW, is limited to Finding B, Low-Rate Initial Production Quantities and Commitments.

Design. Our review of contract specifications and program plans and progress in the technical reviews and audits required by Military Standard 1521-B showed that programs entered LRIP with unresolved design problems or before completion of technical reviews to support the LRIP decision.

Design Problems. We found that six of the seven programs we reviewed for LRIP readiness entered or planned to enter LRIP with unresolved design problems. The Navy MK-50 Torpedo and the Air Force MILSTAR Terminal programs are examples of this problem.

The MK-50 Torpedo Program issued its first LRIP contract with 48 known, unresolved design problems, which were noted by the critical design review. Additionally, 16 percent of the hardware documentation in the Technical Data Package was incomplete at the time of the LRIP decision for MK-50 in May 1989. To complete the technical data package, work on the design problems was necessary during LRIP. MK-50 subsequently experienced program delays; an additional LRIP buy was required due to the correction of technical problems as discussed in Finding B.

The Air Force MILSTAR Terminal Program, as noted in the Inspector General, DoD, Report No. 93-084, "Air Force Strategic and Tactical Relay Satellite Terminal Program," April 13, 1993, was allowed to begin LRIP of MILSTAR command post terminals in December 1989 even though the development contractor had not completed terminal design. Because of the amount of testing and development yet to be done, LRIP contracts were awarded with "B" level specifications (required terminal performance capabilities) rather than "C" level specifications (design drawings). The contractor was not scheduled to deliver some production drawings until January 15, 1993, which was less than 2 months before the scheduled production and deployment decision planned by the Program Executive Officer.

As of November 18, 1992, the contractor was still completing terminal design. This ongoing work included correction of 52 open Category II Product Quality Deficiency Reports. Category II deficiencies are defined by Air Force Technical Order 00-35D-54 as deficiencies attributable to errors in workmanship or nonconformance to specifications, drawing standards, or their technical requirements that can result in hazardous or unsafe conditions for individuals using, maintaining or depending on the product or prevent performance of the product's tactical or strategic function. Additionally,

development work was planned until September 1994. The additional development work was necessary to bring the capacity of the terminal's central processing unit to within 5 percent of the capacity required by the Operational Requirements Document, May 28, 1992.

Programs entering LRIP without a mature, stable design, frequently experienced production-related problems and delays that introduced the need to make additional LRIP awards to preclude the costs associated with a break in production.

Required Reviews. We determined that the Navy EA-6B Remanufacture program and the Air Force C-17 program had not completed required critical design reviews (CDRs) as a prerequisite to LRIP decisions. In addition, the Navy EA-6B had not completed the software test readiness review (TRR). Both Military Standard 1521-B and DoD 4245.7-M state that CDRs and software TRRs are normally performed during Phase II, Engineering and Manufacturing Development, of the acquisition process. Each review provides critical information as to the suitability of planned hardware and software system configurations for production and the completeness of system design. The CDR is defined in DoD Instruction 5000.2 as a review to:

o Determine whether the detailed design of a system meets the performance and engineering requirements of the development specification;

o Establish the detailed design compatibility among the end item and other items of equipment, facilities, computer programs, and personnel;

o Assess producibility and risk areas; and

o Review the preliminary product specifications. CDRs are to be conducted on both hardware and software portions of a system.

The TRR is defined by Military Standard 1521-B as a review of computer software configuration items to determine contractor readiness to begin formal software testing. The impact of software design changes, software test resources, known software problems, and limitations to test software are among the factors assessed.

In Inspector General, DoD, Report No. 93-039, "Audit Report on the Low-Rate Initial Production of the EA-6B Program," December 18, 1992, we reported that the Government would be unable to ensure, before the LRIP decision, that all design areas were adequately examined, that design weaknesses were identified, and that solutions for design-related issues were available. This problem occurred because hardware and software CDRs for the remanufactured EA-6B aircraft (the advanced capability onboard system fully integrated with the vehicle enhancement program and the avionics improvement program) were scheduled to start after the scheduled LRIP decision in September 1992. In addition, we also reported that the Government could not fully assess the

contractor's ability to test software adequately because the TRRs for the receiver processor group (a portion of the advanced capability onboard system) and the overall remanufactured aircraft would not be done until after the scheduled September 1992 LRIP decision.

In Inspector General, DoD, Report No. 91-007, "Audit Report on Selected Acquisition Actions on the C-17 Aircraft," November 2, 1992, we stated that the Air Force exercised an FY 1989 contract option to buy four LRIP aircraft (in addition to two other LRIP aircraft that were already on contract) before completing the CDR of all mission computer software. The C-17 program office considered the CDR to be complete because the top-level software design of the mission computer was reviewed during the April 1989 CDR and the contractor had taken management actions to ensure completion of the detail design of the mission computer software. Military Standard 1521-B states, however, that the CDR should be a formal review of the detail software design. The audit report stated that when the CDR was conducted, detail designs were available for only about 60 percent of all software in the mission computer.

Testing. Our review of testing documentation showed that six of the seven programs we reviewed for LRIP readiness experienced shortfalls in accomplishment and documentation of developmental or operational tests before entering LRIP. These test-related shortfalls included:

o Unresolved deficiencies in the demonstrated ability of systems to meet technical and operational mission requirements; and

o Developmental and operational testing occurring before LRIP that was reduced or limited and as a result did not provide the documentation needed to make an informed LRIP decision.

The April 1990 USD(A) report to Congress concluded that the determination of whether a program is ready to enter LRIP must "be based upon the totality of component, subsystem and system testing that is done (or not done), and the results of this testing" (underscoring added for emphasis). In fact, the report bases determinations concerning the degree of concurrency in a program on the amount of IOT&E completed that supports the entry into LRIP. We consider essential the internal control recommended in the USD(A) report concerning performance of independent operational assessments before committing funds to enter LRIP, as discussed below.

Developmental Testing. Four of the seven programs reviewed for LRIP readiness had significant deficiencies identified through developmental testing that were not resolved (specific fixes identified by contractor) before entering LRIP. Additionally, four of seven programs had reduced or limited developmental testing before the LRIP decision.

Unresolved Deficiencies. The Army's PLS is one example of a system having unresolved deficiencies from developmental testing when going into LRIP. Before its LRIP decision in September 1990, the PLS Program conducted Preproduction Qualification Testing with three competitors using PLS prototypes. No competitor achieved the truck reliability requirement of

1,600 mean miles between hardware mission failures during this technical test. In fact, the contractor selected to produce the PLS only achieved a raw score of 550 mean miles. After an assessment by the Army Materiel Systems Analysis Activity, the score was raised to approximately 900 mean miles, still well below the requirement. This technical problem should have been addressed in additional testing before entering LRIP. However, no additional technical testing was performed before the LRIP decision and the production contract award in September 1990. The next scored technical test events, the Shakedown Test and the Production Qualification Test, occurred 8 and 13 months, respectively, after the LRIP decision and production award.

The Navy EA-6B Remanufacture program also was scheduled to begin LRIP with unresolved deficiencies from developmental testing. In Inspector General, DoD, Report No. 93-039, we stated that developmental testing on the advanced capability onboard system by the Naval Air Warfare Center between January and May 1992 found 46 Part I (safety of flight or inability to complete primary mission) deficiencies. While the developmental test report issued by the Naval Air Warfare Center on May 14, 1992, states that both the Receiver Processor Group and the ALQ-149 Communications Jammer will be satisfactory after correction of the Part I deficiencies, identification of fixes for 32 of the 46 deficiencies was not scheduled until after the LRIP decision.

Reduced or Limited Testing. Inspector General Report No. 93-039 stated that the Navy had allowed a significant reduction in the planned reliability development testing to be completed by the contractor to support the EA-6B LRIP decision. Originally, the engineering and manufacturing development contract required between 1,500 hours and 2,000 hours of testing on each of 13 unique weapon replaceable assemblies making up the receiver processor group. Contract Specification Change Notice 3, submitted by Grumman Corporation in November 1989, reduced the contract requirement to 400 hours on 4 weapon replaceable assemblies deemed to be system representative. This reduction in testing to support the LRIP decision resulted from delays related to design problems experienced by Litton Corporation, the subcontractor responsible for providing the receiver processor group. As of July 1992, the Navy had not formally accepted the change but had operated as if there was acceptance.

DoD 4245.7-M states that reliability development testing reduces the risk of allowing systems with poor reliability to transition from development to production and that this testing should be completed before the initial production decision. This manual also states that test stability, defined as the absence of failures in development testing of a stable design, is essential to reduce risk in the transition from development to production.

Inspector General Report No. 93-039 also stated that developmental testing of the overall EA-6B remanufacture configuration was not planned to support the scheduled September 1992 LRIP decision. Testing of the overall configuration could not occur until the three separate program segments (advanced capability onboard system, vehicle enhancement program, and avionics improvement program) are merged into one aircraft in January 1994.

The MILSTAR terminal program, as noted in GAO Report No. GAO/C-NSIAD-90-28 (OSD Case No. 8177), "Military Satellite Communications: Issues Associated With DoD's MILSTAR Terminal Program," May 23, 1990, provides another example of a system proceeding to LRIP with less testing than originally planned. The GAO concluded that the June 1989 decision authorizing the Air Force to proceed into low-rate terminal production of command post terminals was based on less test data than originally planned, thus increasing the risk that design changes could occur.

According to the GAO report, data from field development tests of EMD terminals were limited due to defects in the terminal radome (relates to the terminal antenna function) and nonavailability of test aircraft.

Operational Assessments. Operational assessments are evaluations of operational effectiveness and suitability made by an independent operational test activity, with user support as required, on other than production systems. Operational assessments differ from operational test and evaluation because production systems are not required; rather, assessments use technology demonstrators, prototypes, or engineering development models that should be production-representative. Also, operational assessments can rely more extensively on computer modeling, simulation, and analysis of program information. The April 1990 USD(A) report to Congress stated that decisions to commit funds for LRIP are supported by operational assessments; however, we found no requirement to perform the assessment before committing funds is presently in DoD Instruction 5000.2. Our review of operational test documentation showed that four of the seven programs examined had only limited operational assessments to support entering LRIP.

In Inspector General Report No. 93-039, we disclosed that an overall operational assessment of the EA-6B Remanufactured aircraft had not been performed in support of the LRIP decision. Operational testing to support the LRIP decision, as the developmental testing discussed above, was limited to the advanced capability onboard system. In addition, operational testing used engineering development models and not production-representative units. Operational testing was further limited by the results of developmental testing. Personnel at the Naval Air Warfare Center, Patuxent River, Maryland, a Navy test activity, stated that, based on developmental test results, the following processing categories were not considered operationally mission-suitable and should not be expected to perform at that level during operational tests:

- o radar warning signal processing and display,
- o identification functions,
- o reactive assignments to complex emitters, and
- o ALQ-149 radar and communication functions.

In summary, the operational testing on the advanced capability onboard system did not provide an adequate basis for proceeding with the planned September 1992 LRIP.

The MK-50 torpedo is another system that provides an example of limited operational assessment before the LRIP decision. The MK-50 was not tested against a fast-deep target before entry into LRIP in March 1989. A program was established in February 1986 to develop a fast-deep target for testing and was to be completed in 1987 at a cost of $4.5 million. However, the program had many technical difficulties, and the program costs increased to $34.5 million. In February 1992, the target program was terminated. The Navy determined that the MK-50 would be tested using simulations rather than a fast-deep target.

JTIDS is another example of limited testing before the LRIP decision. According to GAO Report No. GAO/NSIAD-93-16 (OSD Case No. 8996), "Military Communications: Joint Tactical Information Distribution System Issues," November 12, 1992, the Air Force Operational Test and Evaluation Center (AFOTEC) performed an operational assessment of JTIDS Class 2 terminals from April to May 1989 to support an LRIP decision for the terminals. AFOTEC concluded that some terminals' operations had improved since the first multi-Service operational test (conducted by the Air Force) in 1987. However, the number of operating hours were insufficient to establish any confidence in the test results. Therefore, AFOTEC could not make an adequate assessment of the terminals.

ASPJ provides a final example of excessive limitations to operational testing before entering LRIP. IG, DoD, Audit Report No. 90-066, "Hotline Allegations Regarding the Milestone IIIA Production Decision for the Airborne Self-Protection Jammer Program," May 10, 1990, reported on the extent of operational test and evaluation on the ASPJ. Three IOT&E efforts (Phases IIA, IIB, and IIC) were conducted between June and November 1988, before the ASPJ LRIP decision in August 1989. The purpose of the IOT&E efforts was to resolve or partially resolve critical operational test issues before making ASPJ production decisions. The ASPJ Test Plan listed 20 critical operational test issues that required resolution.

None of the three test efforts was conducted with a production-representative ASPJ in an operationally realistic threat environment. The first of these test efforts, Phase IIA, was conducted in June 1988 by the Commander, Naval Operational Test and Evaluation Force (OPTEVFOR), and the Commander, AFOTEC. A purpose of the test, done when the engineering and development model of ASPJ was at an early stage of development, was to assess the potential effectiveness and suitability of the ASPJ and support Navy and Air Force decisions to buy 14 ASPJ production verification units. Neither test organization was able to fully assess ASPJ's suitability because of limitations to the scope of testing. The test organizations concluded that the ASPJ was potentially operationally effective and, therefore, supported a recommendation to buy the 14 production verification units.

The Commander, OPTEVFOR, conducted a portion of Test Phase IIC in July 1988, and the Commander, AFOTEC, conducted the remainder of the testing in November 1988. Test phase IIB was conducted in September 1988 by the Commander, AFOTEC. Test limitations prevented Navy and Air Force test personnel from assessing 9 of the 20 critical operational issues and from fully

resolving the remaining 11 critical operational issues during operational tests. As a result, operational testers were prevented from fully assessing whether ASPJ would sufficiently and reliably increase aircraft survivability against enemy defense systems, thereby providing an operational assessment of operational effectiveness and suitability before the August 1989 LRIP decision.

Three of the four programs we cited as having had limited operational assessments before LRIP had already entered LRIP at the time of our review. These programs were the MK-50, ASPJ, and the JTIDS Class 2 and 2H terminals. The difficulties these programs experienced in LRIP resulting from testing shortfalls and unresolved operational issues are discussed in Finding B. For the fourth system, EA-6B, entry into LRIP was delayed from September 1992 to allow for additional operational testing and design work. This delay was responsive to the intent of our recommendations in our draft of Inspector General, DoD, Report No. 93-039; this draft report was issued August 14, 1992.

Manufacturing. Our review of program office documentation showed shortfalls in meeting requirements provided by Military Standard 1521-B, "Technical Review and Audits for Systems, Equipments, and Computer Software," for performance of production readiness reviews before entering LRIP. In addition, EMD models of systems were incomplete and not reasonably representative of production articles for purposes of operational testing and assessment.

Production Readiness Reviews. DoD Instruction 5000.2 defines a system as ready for production when the producibility of the production design and the managerial and physical preparations necessary for initiating and sustaining a viable production effort have progressed so that a production commitment can be made without incurring unacceptable risk. A Production Readiness Review (PRR) is a technical review of the completeness and producibility of the product design and the planning and preparation for production. A PRR typically addresses product design, industrial resources, production engineering and planning, materials and purchased parts, and quality assurance. A PRR must be satisfactorily accomplished before a production decision. PRRs can identify potential deficiencies in a contractor's program management, logistics support, funding, and manufacturing programs that could adversely affect production schedules, costs, and technical performance.

Military Standard 1521-B requires these reviews to be done incrementally with the first within 90 days of the critical design review. Subsequent reviews are to be at least yearly thereafter until the program passes Milestone III, Production Approval. We found that four of seven programs in our review did not meet the Military Standard requirements for PRRs because the reviews were either not performed or unduly limited in coverage.

Review Performance. No PRRs were performed for PLS program before entry into LRIP. Although PLS is based on the integration of present technology, it is a unique system. Major modifications to existing technology were required for PLS to meet the requirements of the Army. Requirements included a new central tire inflation system, a new transmission

system, and unique axles to meet the high-density weight requirements. In view of the considerable changes to existing technology and major integration effort required for PLS, a PRR should have been performed before beginning LRIP.

The Navy MK-50 program did not perform annual incremental PRRs during engineering and manufacturing development as required by Military Standard 1525-B. The Military Standard requires the incremental review process so that the earlier PRRs can focus on gross-level concerns, such as identifying high-risk and low-yield manufacturing processes and producibility of the proposed design, while the later reviews are more refined and deal with concerns such as production planning, facilities allocation, and fabrication of tools and test equipment.

Review Coverage. As documented in Inspector General Report No. 93-039, the Navy did not perform PRRs for the overall EA-6B remanufacture program. The only PRRs planned to be accomplished before the LRIP decision were single reviews for two components of the advanced capability onboard system, the Receiver Processor Group and the ALQ-149 Communications Jammer. The receiver processor review was scheduled for July 1992, and the ALQ-149 review was done in August 1990. In addition to the advanced capability onboard system, the overall remanufactured aircraft also included the Vehicle Enhancement Program (maneuverability enhancements and engine upgrades) and the Avionics Improvement Program (installation and integration of advanced capability system and vehicle enhancements). Those additional parts of the overall remanufacture program were not planned to be subjected to PRR before LRIP.

Engineering Development Models. As discussed, engineering development models can be used to perform operational assessments supporting initial commitment of long-lead procurement funding and entry into LRIP. The April 1990 USD(A) report to Congress proposed that DoD ensure that engineering development articles, used to perform testing upon which initial production decisions are made, be representative of the production configuration. This proposal is not in DoD Instruction 5000.2. Delivery schedules for engineering development models of systems were frequently not met; therefore, testing of the models before entering LRIP was impaired. Additionally, contractors did not ensure that the models were complete and met contract specifications. In five of the seven programs, we found that contractors had not met delivery schedules established for engineering development models of systems.

For example, in Inspector General, DoD, Reports No. 92-089, "Cost-Effectiveness Analysis for the Air Force C-17 Program," May 12, 1992, and No. 91-007, "Selected Acquisition Actions of the C-17 Aircraft," November 2, 1990, we found that the C-17 program had experienced major delays in the development of software and hardware related to the aircraft's Electronic Flight Control System and the mission computer. These delays were a primary cause for the date of the first flight of the test aircraft to be postponed from February 1990 to September 1991. In our opinion, additional time was needed because

the contractor had not recognized schedule risk, had not prepared integration test planning in sufficient detail, and lacked personnel experienced in integrating complex avionics systems. When the test aircraft flew and became a functional test asset, the Air Force had already issued contracts for three LRIP lots, which involved a total of 10 aircraft at a total ceiling price of $2.9 billion.

Inspector General, DoD, Report No. 93-039 disclosed that only one of the six models of the Receiver Processor Group (part of the remanufactured aircraft's advanced capability onboard system) had been delivered as originally scheduled on the EMD contract. As of July 1992, the other five engineering development models were between 39 and 50 months behind the original contract schedule. Two models were at the contractor's facilities and were being used for testing, but these models had not been accepted by the Government. The delivery date for models 2 through 6 was set for December 1993.

In four of the seven programs, we observed that contractors had delivered engineering models of systems that were incomplete or did not meet contract specifications.

For example, our Report No. 93-039 stated that the only development model of the Receiver Processor Group that the Government had accepted was missing 5 of the 21 weapon replaceable assemblies that were to be included. Another six assemblies did not meet configuration requirements. As a result, the Government withheld payment of $4 million on the accepted terminal. Additionally, the Navy cited limited service life remaining on the accepted Receiver Processor Group model as one reason to shift reliability development testing from the engineering and manufacturing development contract to the LRIP effort.

In the Air Force MILSTAR Terminal Program, models available for testing before the June 1989 LRIP decision were not fully mature in design. Contractor schedule documentation relating to the EMD contract showed that deliveries of final versions of development models did not begin until 1991. In Inspector General, DoD, Report No. 93-084, we noted that the LRIP contracts were issued in December 1989 when the developing contractor had not completed terminal design. As discussed under "Unresolved Design Problems," the LRIP contracts were awarded with "B" level specifications (required terminal capabilities rather than "C" level specifications (design drawings).

Entry Into Low-Rate Initial Production

The primary cause of the deficiencies identified was the lack of a properly planned and structured acquisition decisionmaking process that provides for essential oversight of program readiness to commence LRIP.

In our opinion, premature entry into LRIP is a systemic deficiency that can only be corrected through a fundamental change in the acquisition oversight status accorded the LRIP decision. The present guidance, provided by DoD Instruction 5000.2, is intended to provide flexibility in structuring LRIP within acquisition strategy to accommodate the unique aspects of individual programs. However, while some flexibility is necessary, basic systems engineering management concepts such as design maturity, producibility, testing, and production readiness are applicable to virtually all programs. These factors should be thoroughly reviewed with the overall program status before entry into LRIP. Establishment of LRIP as a separate milestone decision point that can be waived by the milestone decision authority at Milestone II, Development Approval, if warranted by the nature of a particular program, is required to ensure program preparedness to proceed into LRIP. While additional oversight for LRIP will not substitute for sound program management, the level of oversight does directly effect the focus of program management. In our opinion, additional focus on entry into LRIP is warranted.

Significant program changes and redirection often occurred after the Milestone II, Development Approval, decision that necessitate revision of acquisition strategies, program baselines, and other program parameters. For example, on the seven programs reviewed for LRIP readiness, an average of 59 months elapsed between the Milestone II decision and entry into LRIP. Given the dynamics of most major programs, this period can encompass numerous significant changes that have various origins and levels of approval. All programs were impacted to varying degrees by changes in budgets during this period. While Defense Acquisition Board and Military Department program reviews occurred during the 59-month period in most cases, these reviews varied significantly in focus, content, and required documentation. Therefore, we consider a clearly defined milestone review essential.

Additionally, DoD guidance is required on initial commitment of long-lead procurement funding and award of additional LRIP production lots after entry into LRIP. Specifically, exit criteria for these decision points should be required, not just suggested. Required exit criteria should include the operational assessments recommended by USD(A) in the April 1990 report to Congress before commitment of long-lead procurement funding, completion of critical design and production readiness reviews, accomplishment of significant levels of developmental testing, and at least some operational testing before entry into LRIP. Additionally, systems engineering and testing accomplishments should partially form the basis for exit criteria for each LRIP lot after entry into LRIP. The approval authority for these decisions should be established by the milestone decision authority upon entry into EMD, together with the LRIP quantities required so as to provide a basis for long-lead funding commitment.

Regulations and Guidance. Major Defense acquisition programs are entering LRIP prematurely because of inadequate regulation and guidance. Specifically, the DoD Instruction 5000.2 did not provide adequate guidance on:

o Minimum program accomplishments required before entering LRIP to ensure that a stable design exists, test results support proceeding with the decision, and readiness for production has been confirmed;

o Establishment of program-specific exit criteria for initiation of long-lead funding for LRIP, entry into LRIP, and award of subsequent initial production lots; and

o Milestone decision authority reviews of program status and accomplishments, including reaffirmation of the LRIP quantities and acquisition strategy before entering LRIP.

We believe that proper timing of the LRIP decision, which starts contractor production lines, is critical to a successful acquisition strategy. Once in production, programs tend to stay in production regardless of the technical or operational suitability problems encountered with LRIP units. Breaks in production are resisted due to the costs associated with these breaks, such as closing and later restarting production lines at both prime and subcontractor levels, and the loss of learning and experience that occurs. To give proper emphasis to the LRIP decision as critical to the acquisition decision process and to avoid the potential costly shutdown of production lines, we believe that LRIP should be established within DoD Instruction 5000.2 as a separate milestone decision point.

In addition, DoD has issued a draft revision to Military Standard 499A, "Systems Engineering," May 1, 1974, which does not establish a direct link between systems engineering requirements and provision of initial long-lead procurement funding and entry into LRIP. The draft, dated May 6, 1992, includes guidance on exit criteria for certain technical reviews, such as critical design review, but clearly indicates that the guidelines are not mandatory. The draft guidance would require revision to directly link the systems engineering approach with the LRIP and full-rate production decision points to be consistent with the recommendations in this report. Based on the systems engineering tasks defined in the draft revision to Military Standard 499B, DoD has also drafted a proposed Military Handbook 499-3. Dated December 16, 1992, the draft handbook proposes that functional configuration audits and a new requirement called "Process Verification" confirm readiness to enter LRIP. These assessments are conducted to demonstrate that system design, development, and manufacturing processes are sufficiently mature to merit initiation of LRIP. The concepts in the draft handbook, if implemented, would provide for significant reductions in program risk associated with entry into LRIP and represent a positive management initiative to correct the types of deficiencies noted in this report.

Acquisition Planning. Major Defense acquisition programs were also entering LRIP prematurely because acquisition plans for transitioning to production, set when programs passed Milestone II, were developed when urgency to meet threats justified higher levels of concurrency on the programs reviewed, including scheduling production decisions before design would be complete. All programs in our audit had Milestone II decisions before 1988. As the USD(A) stated in May 1992, in the present environment, programs normally

should not need to incur the previously unacceptable levels of program risk in transitioning from development to production. High levels of concurrency, driven by demanding initial operational capability dates, had been justified based on the threat; however, it is not evident from the programs reviewed that the high concurrency actually contributed to more timely fielding of the weapon systems.

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* As a result, the Air Force was granted LRIP authority in June 1989 and issued LRIP contracts in December 1989 when terminal design was still incomplete (See "Design Problems," above).

Impact of Present LRIP Process

Increased program risk is the primary impact of the deficiencies noted in the LRIP process. We found that the program risk associated with highly concurrent acquisition strategies was frequently understated, in part because risk was not evaluated relative to the proposed guidelines in the April 1990 USD(A) report to Congress, which focuses on the amount and results of IOT&E completed. The understated program risk then impacted the amount of risk management considered necessary by the program officials and the milestone decision authorities.

When Military Departments prematurely commit to LRIP on systems with an unstable design, the development and production effort must be done with excessive concurrency (overlap between the development and production processes). This concurrency increases the potential for:

o Program cost increases;

o Undetected design deficiencies that are difficult to fix in production and can impact achievement of required performance;

o Excessive LRIP quantities relative to total planned program buys driven by schedule delays and the need to sustain production lines; and

* Predecisional data removed.

o Misuse of funds in violation of law where development and procurement funding are not properly segregated and accounted for.

Program Cost Increases. Ideally, concurrency can reduce the cost of fielding major systems. However, undue concurrency resulting from premature entry into LRIP based on the status of design, testing, and production readiness invariably drove cost increases on the programs reviewed. We could not quantify the precise dollar amount of cost increases on the programs reviewed associated with higher levels of concurrent development and production because of the technical assumptions required on recognition and correction of design and producibility deficiencies in less concurrent strategies. Nonetheless, we consider the cost increases on these programs to at least be partially attributable to higher levels of concurrency risk introduced through premature LRIP decisions.

Design Deficiencies. As discussed, six of the seven programs reviewed for LRIP readiness had unresolved design deficiencies when LRIP started. The introduction to DoD 4245.7-M, "Transition from Development to Production," states that

> Many programs simply cannot succeed in production, despite the fact that they've passed the required milestone reviews. These programs can't succeed for technical reasons, notwithstanding what is perceived as prior management success related to DoD acquisition policy. A poorly designed product cannot be tested, efficiently produced, or deployed. In the test program there will be far more failures than should be expected. Manufacturing problems will overwhelm production schedules and costs. The best evidence of this is the "hidden factory syndrome" with its needlessly high redesign and rework costs.

Further, Inspector General, DoD, Report No. 93-017, "Critical Design Review Process for Major Defense Acquisition Programs," November 5, 1992, found the CDR process was not ensuring that design had stabilized before entering production. Among the specific findings, design deficiencies were not being resolved before stated completion of CDR with corrective action plans in place, thus leading to premature entry into production. The audit results were based on six representative Major Defense Acquisition Programs. In the Inspector General report, we recommended that CDR be completed before entering LRIP with all design deficiencies resolved.

Excessive LRIP Quantities. Entering LRIP before completion of prerequisites in design, testing, and production preparation creates the potential for LRIP quantities that become excessive relative to total planned program buys. The potential for excessive LRIP quantities occurs because production lines continue as solutions are sought for technical problems. Finding B discusses this problem and its impact on the systems in our audit.

Use of Funds. High levels of concurrency caused by premature LRIP decisions significantly complicate accurate cost accounting and cost estimating. While properly structured contracts and sound contractor accounting systems can contribute significantly to proper cost accounting, premature entry into LRIP and the often-associated redesign and rework can complicate accounting decisions. Therefore, the potential for misuse of appropriated funds increases when programs have concurrent development and production efforts because large amounts of Research, Development, Test, and Evaluation funding are expended at the same time as procurement funding.

The risk is especially great when both types of funding are on the LRIP contract, as with the Air Force MILSTAR Terminal and Titan IV Programs. In the Inspector General, DoD, Report No. 93-084, we found that the Air Force did not provide adequate oversight or control over the expenditures of multiple appropriations on the LRIP contracts for the terminals. As a result, violations of United States Code, title 31, section 1301 occurred, which requires that appropriations be applied only for those purposes for which the appropriations were made. Other fiscal statutes could potentially be violated under these circumstances. As a result of the implementation of recommendations in Inspector General, DoD, Audit Report No. 92-064, "Titan IV Program," March 23, 1992, the potential for misuse of funds should be greatly reduced because segregation of costs by appropriations will be required for purposes of contractor payment.

Conclusions

To minimize the risk of transitioning from development into LRIP in the present reduced-threat environment, programs should not normally transition until they have demonstrated:

o A near absence of unresolved deficiencies in developmental testing;

o Successful completion of operational assessments on production-representative units by an independent Military Department test agency;

o Design maturity, meaning no unresolved issues (defined as a lack of agreed-to fixes) from the technical reviews, developmental testing, or operational assessments required before LRIP, which could necessitate significant design changes; and

o Certification of the manufacturing process through successful completion of PRRs.

Reaffirmation of LRIP quantities approved at the Milestone II decision point is required because of the number of program changes that can occur between Milestone II and the LRIP decision. These changes include budget reductions, test and delivery schedule slippages, and reassessment of the threat environment. Additionally, to ensure that entry into LRIP is fully supported by

program accomplishments and that planned numbers of LRIP units have been properly defined in terms of testing and production needs, we believe that the LRIP decision should be established as a separate acquisition milestone.

In addition, a separate milestone review, which would include confirmation of required initial production quantities, attainment of all required exit criteria, and designation of approval authority for subsequent LRIP contracts, should be required to ensure programs are ready to enter LRIP. Program documentation listed in Appendix F should be required for the LRIP milestone review.

Our conclusions are supported by recent changes in DoD acquisition policy. The USD(A) stated in a May 20, 1992, acquisition policy memorandum that because of the breakup of the Warsaw Pact and the dissolution of the Soviet Union, the pressure of rapidly advancing technology in the hands of potential enemies has significantly lessened. The memorandum further states that the need to replace existing weapons systems to maintain a significant technological advantage is no longer as urgent and that program concurrency can be reduced. Entering production prematurely and performing developmental work as part of production contracts is contrary to the intent of this guidance.

Our conclusions are further supported by the problems that arose as a result of excessive concurrency in programs. These problems are discussed in Finding B. and documented in other recent Inspector General, DoD, and GAO reports (See Appendixes C. and D.). Additionally, our conclusions are consistent with the USD(A)'s proposed (but only partially implemented) guidelines for explicitly linking the initiation of program milestone decisions with demonstrated program accomplishments as discussed in the "Report on Guidelines for Determining the Degree of Risk Appropriate for the Development of Major Defense Acquisition Systems, and Assessing the Degree of Risk Associated With Various Degrees of Concurrency; and Concurrency in Major Acquisition Programs" issued April 17, 1990. The April 1990 report also proposes that concurrency risk be reduced through "aggressive" use of prototyping and testing to identify and remedy problems well before production starts, citing the Packard Commission as the source of this proposal. The LRIP recommendations in the USD(A) report are partly predicated on extensive use of prototyping before entry into EMD. We are separately evaluating prototyping in our "Audit of DoD Use of Prototyping Acquisition Strategies for Major Defense Acquisition Programs" (Project No. 2AE-0051).

Recommendations, Management Comments, and Audit Response

We recommend that the Under Secretary of Defense for Acquisition:

1. Revise DoD Instruction 5000.2 concerning major Defense acquisition programs to:

a. Establish a required milestone review for entry into low-rate initial production, including confirmation of required initial production quantities, attainment of all required exit criteria, and designation of approval authority for subsequent low-rate initial production contracts. Program documentation listed in Appendix F should be required for the milestone review.

b. Provide guidance on the specific minimum required program accomplishments for initially committing long-lead procurement funding for low-rate initial production, entering low-rate initial production, and awarding subsequent low-rate initial production lots. As a minimum, operational assessment, design and production readiness review, and operational testing prerequisites should be established.

c. Require that program-specific exit criteria be established for initial long-lead procurement funding, entry into low-rate initial production, and subsequent initial production lots at the Milestone II decision point and incorporated as events in development contracts.

d. Direct that engineering and manufacturing development contracts include requirements for production-representative engineering development models for purposes of performing operational assessments before initially committing long-lead procurement funding, unless specifically waived by the milestone decision authority at Milestone II, Development Approval.

2. Require Military Standard 499A to include a direct link between systems engineering requirements and low-rate initial and full-rate production decisions.

Management Comments. The Director, Acquisition Program Integration, responded for the Under Secretary of Defense for Acquisition. The Director stated that, in general, he was supportive of the finding and recommendations, but in his view most of the problems noted in our report were due to poor compliance with current LRIP policy rather than the policy itself. The Director concurred with Recommendations A.1.b. and A.2. and partially concurred with Recommendation A.1.c. The Director nonconcurred with Recommendations A.1.a. and A.1.d.

Regarding Recommendation A.1.a., the Director stated that the current policy for optional LRIP milestone reviews for Acquisition Category I programs was appropriate and that a required milestone review before entry into LRIP is not

needed. The Director did not believe that the LRIP Milestone IIIA, provided for in DoD Instruction 5000.2 before February 1991, had been effective and, therefore, did not believe reintroduction of an LRIP milestone would be a corrective action. The Director also believed that adding a new milestone may cause confusion for non-major programs that really need no LRIP review.

Regarding Recommendation A.1.b., the Director agreed to revise DoD Instruction 5000.2 to provide increased guidance for major Defense acquisition programs on LRIP accomplishments regarding operational assessment, design, and production readiness reviews, and operational testing prerequisites.

Regarding Recommendation A.1.c., the Director concurred that, for major Defense acquisition programs, DoD Instruction 5000.2 should be revised to add program-specific exit criteria for LRIP but believed that the inclusion of the criteria in development contracts should be at the discretion of the USD(A).

Regarding Recommendation A.1.d., the Director nonconcurred with revising DoD Instruction 5000.2 to require engineering and manufacturing development contracts for major Defense acquisition programs to require production representative engineering and development models for LRIP. The Director stated that this requirement is too stringent and that current Milestone II policy already states that LRIP units are "production configured or representative."

Regarding Recommendation A.2., the Director agreed to revise Military Standard 499A to include a direct link between systems engineering requirements and low-rate initial and full-rate production decisions.

The full text of the Director's comments is in Part IV.

Audit Response. Comments by the Director, Acquisition Program Integration, are partially responsive.

o Concerning the response to Recommendation A.1.a., we disagree with management's assertion that a required milestone review for entry into LRIP would not help avoid the types of problems noted during our review. While poor compliance with existing LRIP policy was certainly a causative factor to the problems noted, we strongly believe that an equal or greater causative factor was the lack of policy guidance on the program-specific accomplishments necessary to support transition to LRIP. Six of the eight programs in our review had LRIP milestone reviews before February 1991, when the September 1987 version of DoD Instruction 5000.2 provided for a "Milestone IIIA" review before beginning LRIP. However, there were fundamental differences between the guidance for milestone reviews in the earlier version of the Instruction and the guidance in the February 1991 version. The current version of the Instruction, which does not provide for a "Milestone IIIA" review, gives detailed guidance on the objectives and decision criteria that apply to each of the currently established acquisition milestones. The current version also provides excellent guidance on the minimum required accomplishments of each acquisition phase leading to a milestone and provides for the establishment of program-specific exit criteria. These exit criteria provide event-based justification for making acquisition decisions. We believe

that the lack of specific guidance in the earlier version of the Instruction made it easier to change or ignore established acquisition strategies and caused the ineffective LRIP milestone reviews.

A properly planned and structured acquisition decision process that provides for essential oversight of program readiness to enter LRIP is imperative to minimize the types of problems noted in our report, especially with regard to the adequacy of risk reduction efforts before production committments. The oversight needed for the LRIP decision can best be achieved by modifying the Instruction to require a milestone review before entry into LRIP and by defining the objectives, decision criteria, and minimum required accomplishments that should apply to that milestone similar to the guidance provided for existing milestones. In addition, we disagree with management's assertion that a required milestone review for LRIP could cause great confusion for non-major programs that really need no LRIP review. If there was no valid need for an LRIP review for a non-major program, the milestone decision authority could elect to grant a waiver to the requirement. Waivers should be granted only after careful consideration, however, even when commercial products are involved. LRIP of any product should not begin until test and evaluation determine that the design has the potential to meet military requirements. We ask management to reconsider its position on establishment of a required milestone review for entry into low-rate initial production.

o Concerning the response to Recommendation A.1.b., management agrees that DoD Instruction 5000.2 should be revised to provide increased guidance on required program accomplishments before entering LRIP but provides no details on what revisions will be made and when they will be implemented. We ask management to define what specific minimum program accomplishments the planned revision to the Instruction will include relating to initial commitment of long-lead procurement funding for LRIP, entering LRIP, and awarding subsequent LRIP lots. Additionally, we request management to provide an estimated date for the issuance of the planned revisions.

o Concerning the response to Recommendation A.1.c., management agrees that DoD Instruction 5000.2 should be revised to add program-specific exit criteria for LRIP but is unclear as to which LRIP-related decision points will require exit criteria under the planned revision and when the revision will be made. Our recommendation identified three LRIP-related decisions: committing funding for initial long-lead procurement, entering LRIP, and awarding subsequent LRIP lots. We believe that program-specific exit criteria are needed for each decision as a risk management tool to ensure that funds are not committed until specific events or accomplishments have occurred. Additionally, we believe management's position that inclusion of exit criteria in development contracts should be done at the discretion of the USD(A) is not supported by policy currently in DoD Instruction 5000.2. The Instruction requires that contracting organizations must support the acquisition strategy by imposing links between contract events and demonstrated accomplishments in development and initial production and the milestone decisions. The events in the contracts must also support the exit criteria for the phase. Based on the guidance in the Instruction, we believe exit criteria should be incorporated as required accomplishments in development contracts unless waived by the

USD(A). We ask management to reconsider its position on inclusion of exit criteria events in development contracts and to provide estimated dates for all planned corrective actions.

o Concerning the response to Recommendation A.1.d., we agree with management's assertion that the requirement for "production representative models" for purposes of performing operational assessments before initially committing long-lead procurement funding may be unnecessarily stringent. However, we continue to believe that development contracts should include a requirement to provide, before commitment of long-lead procurement funding, engineering and development models that approximate the planned production configuration for performing operational assessment. We agree that the definition of an engineering and development model for this purpose requires clarification and suggest Military Standard 499A contain a description of what constitutes an adequate engineering development model for operational assessment purposes. Our position is based on the DoD Instruction 5000.2 requirement that contracting organizations must support the acquisition strategy by imposing links between contract events and demonstrated accomplishments in development. This requirement could be waived by the Milestone decision authority at the Milestone II decision point, for example if operational assessment of prototype hardware during Phase II, Demonstration and Validation, has disclosed no areas of significant (moderate or higher) risk or programmatic voids. We request management reconsider its position on the provision of engineering and development models for operational assessment before commitment of long-lead procurement funding.

o Concerning the response to Recommendation A.2., management's agreement to modify Military Standard 499A is in full concurrence. We request management provide an estimated date for completion of the planned revision.

Other Management Comments and Audit Response to the Comments

The Army Director for Combat Services Support disagreed with information presented in the finding concerning the PLS program. He stated that the finding did not address considerations that led the Army to award the LRIP contract when competing contractors had not met established exit criteria for the award. These considerations included a congressionally mandated deadline to award a production contract, historical growth of reliability in other truck programs, and the effect of a delay in contract award on competitive contract price. The Director also questioned our reference for stating that the PLS program had not adhered to the established acquisition strategy and internal controls. The Director additionally stated that the primary reason the PLS program did not have a PRR before beginning LRIP was that the program had evaluated production readiness on competing PLS contractors during the preceding 2 years.

We believe the primary consideration in the decision to begin LRIP on PLS should have been the significant difference between the 1,600 Mean Miles Between Hardware Mission Failures established as an exit criteria for LRIP and the 900 miles (56 percent of the exit criteria) that the contractors were able to accomplish. In a July 9, 1990, memorandum provided for the Conventional Systems Committee Milestone IIIA (LRIP decision) for PLS, the PLS action officer in the Office of the Assistant Secretary of Defense for Production and Logistics stated that test results for the PLS were disappointingly low and indicated the program was not ready to enter LRIP. Concerning the acquisition strategy and internal controls, we believe, that by disregarding the established exit criteria, the Army deviated from the acquisition strategy and did not follow internal controls established to ensure that production began only after the program had met reliability thresholds.

In response to the Director's comments that a PRR was not necessary before LRIP because of previous evaluations of competing contractors, we found that the PLS project engineer in the Office of the Assistant Secretary of Defense (Production and Logistics) had stated, in a July 9, 1990, memorandum provided for the Conventional Systems Committee Milestone IIIA (LRIP decision) for PLS, that the Army had not followed recommendations to conduct formal PRRs for the program. The recommendations for formal PRRs resulted from an April 1988 DoD Product Engineering Services Office assessment of the PLS acquisition strategy. According to the assessment, formal PRRs were necessary due to the extensive modifications and redesign efforts that would be required for competing contractors to develop a new class of vehicles that could meet Army specification requirements.

Based on the Army response, we have changed the PLS information reported in the finding by clarifying that the period during which PRRs were not conducted for the program was up to and including the date of entry into LRIP. In addition, we have deleted statements citing the nondevelopmental nature of the program as the reason that PRRs were not performed before LRIP.

The full text of the Army comments is in Part IV.

The Deputy Assistant Secretary of the Air Force for Acquisition disagreed with information provided in the finding based on audit results documented in Report No. 93-084, "Air Force Strategic and Tactical Relay Satellite Terminal Program," April 13, 1993. The Deputy Assistant Secretary disagreed with our assertion that the Air Force MILSTAR Terminal Program went to LRIP prematurely, stating that the program met criteria for start of initial production provided in the Program Management Directive for the program. The Director further stated that the issues presented in Report No. 93-084 were still awaiting resolution at the time our draft LRIP report was issued. The Assistant Secretary requested that we wait for the resolution of these issues before issuing the final report.

We continue to believe that the Air Force MILSTAR Terminal Program entered LRIP without completing prerequisites in design, testing, and production. While the program may have met the specific criteria provided by the Program Management Directive for start of initial production, much research and development work still remained. In Report No. 93-084, we noted that the terminal program approached the LRIP decision *

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* In addition to the design, testing, and production readiness shortfalls mentioned in the finding, our review determined that the product configuration established at the beginning of LRIP did not include hardware or software changes that might be required to meet the Maintainability Demonstration required under the EMD contract.

We completed resolution of outstanding issues on Report No. 93-084 on August 30, 1993. With regard to the finding, these issues concerned recommendations for the Air Force to identify the extent of any violations of fiscal statues that had occurred pertaining to MILSTAR terminal funding and to establish procedures for proper control of expenditures by appropriation. The Air Force has completed a review of progress payment liquidation against deliveries and internal control procedures related to progress payments and found no basis for believing that violations had occurred. In addition, OSD plans to require that contractor's requests for progress payments must identify amounts by contract line items or subline items to the disbursing officer. When these new guidelines become part of governing directives, the Air Force has agreed to apply them to the MILSTAR terminal progress payments.

Based on the Air Force response, we have made the following changes to the MILSTAR terminal information reported in the finding:

o Under "Design Problems," we changed the description of the 52 open product quality deficiencies to include the description provided in Report No. 93-084: "This ongoing work included the correction of 52 open Category II Product Quality Deficiency Reports." "Category II deficiencies are defined by Air Force Technical Order 00-35D-54 as deficiencies attributable to errors in workmanship or nonconformance to specifications, drawing standards, or their technical requirements that can result in hazardous or unsafe conditions for individuals using, maintaining or depending on the product or prevent performance of the product's tactical or strategic function."

o Under "Review Performance," we deleted MILSTAR from the examples of programs that had not performed required annual incremental PRRs.

The full text of the Air Force comments is in Part IV.

* Predecisional data removed.

Finding B. Low-Rate Initial Production Quantities and Commitments

The LRIP acquisition strategies for major Defense acquisition programs did not effectively limit production quantities and control program risk before Milestone III, Production Approval. Deficiencies in planning and executing the transition from LRIP to full-rate production were identified. LRIP acquisition strategies were not effective because production decisions were scheduled before system design had stabilized. LRIP procurement contracts were awarded while effort to stabilize the design and production process took place. While the establishment of exit criteria for planned production decisions was required starting in 1991, exit criteria were not effectively used to control low-rate initial production commitments. As a result, the Government incurred the excessive program risk of over-commitment to production of systems that have not proven their production readiness or technical and operational suitability and that may have serious deficiencies that may be difficult and costly to fix in production.

Background

The Milestone III Production Approval represents a commitment to build, deploy, and support a system. It is the last major acquisition decision before systems move into full-rate production and deployment to operating forces. DoD Instruction 5000.2 states that the decision to proceed to full-rate production should not be made until test results and low-rate initial production experience provide reasonable assurance that the design is stable, operationally acceptable, logistically supportable, and capable of being produced efficiently.

Planning for Low-Rate Production

Lead time for production of LRIP units was not adequately considered in structuring LRIP programs. As a result, annual LRIP contracts were awarded when technical deficiencies and program development delays did not support further production commitments. In essence, LRIP was used as an extension of engineering development. Insufficient attention was focused on statutory requirements to use LRIP only for the minimum essential quantities required for operational test and evaluation, establishment of a production base, and ramp up to full-rate production. Specifically, minimum essential quantities were determined primarily by contractor or initial production schedules and funding

availability rather than the goal of minimizing total LRIP quantities. No guidance was established to determine minimum LRIP quantities or required analyses to support the minimum quantity and demonstrate compliance with United States Code, title 10, section 2400.

Annual Low-Rate Initial Production Contracts. Four of the seven programs in our review of Low-Rate Initial Production Quantities and Commitments had awarded (or planned to award) three or more LRIP annual contracts while the programs were experiencing technical difficulties or program delays. Another program, the Sensor Fuzed Weapon, had an acquisition strategy that included three LRIP awards before the Milestone III, Production Approval. Exit criteria had only been established for the first LRIP award.

The low-rate initial production of the JTIDS Class 2 and Class 2H terminals, as documented in the GAO Report GAO/NSIAD-93-16, shows how technical problems often have little impact in determining whether LRIP continues. Before the award of the second LRIP terminal lot in July 1991, Navy's OPTEVFOR reported 14 limitations that prevented the test personnel from determining the terminal's operational effectiveness and suitability. Although the test report showed that the terminals were operationally effective in some categories, the terminals failed most operational suitability tests.

Despite the lack of adequate testing and poor test results, the Air Force and the Navy made a joint decision to award Lot 2 production contracts to two contractors in July 1991 for 53 terminals. Subsequent operational testing to support a Lot 3 LRIP award was completed by the Navy's OPTEVFOR in March 1992. Although the test report concluded that the terminals had the potential to be operationally effective and suitable, it stated that the number of significant deficiencies was alarming. The OPTEVFOR report identified five major deficiencies that needed to be corrected before approving the system for limited fleet introduction and 53 additional deficiencies that needed to be corrected and verified by more operational testing. In addition, the test report also identified 15 test limitations that prevented the resolution of critical operational issues. Despite these deficiencies, the LRIP Lot 3 contract was awarded in September 1992.

The MK-50 program provides a final example of continued LRIP awards despite technical deficiencies and program delays. The initial LRIP contract was awarded even though the Technical Data Package was not completed, the second source was not qualified, and the PRR indicated many problems and concerns. Two additional LRIP contracts were awarded with the Technical Data Package still incomplete, the second source still unqualified, and no subsequent required PRRs done to check the original production concerns. A fourth LRIP contract was authorized by the USD(A) but was delayed due to an anomaly report issued by the Commander of Navy OPTEVFOR.

In our opinion, the continuing LRIP awards occurred partly because programs had entered LRIP prematurely, without meeting necessary prerequisites in design, testing, and production readiness (see Finding A). Often, the programs had entirely adequate acquisition strategies approved, which established appropriate prerequisites for low-rate initial production decisions, but the acquisition strategies were either changed or not adhered to before the low-rate initial production decision. As a result, design deficiencies carried over into LRIP had to be corrected while production lines ran. In the worst case, additional LRIP contracts were awarded because of the need to sustain production lines even though systems were not meeting established requirements. In addition, when exit criteria are not established for individual LRIP awards, programs do not have an effective means of measuring progress toward or justifying proceeding with these production decisions. Appendix G provides a summary of those programs having awarded or planning to award three or more LRIP lots.

Managing Low-Rate Initial Production Quantities. We found that additional management attention is required in establishing LRIP quantities and holding those quantities to the minimum needed assets. The number of units generally used in IOT&E is small compared to the units produced under LRIP. The majority of LRIP effort falls within the category of units required to establish a production base and permit an orderly increase to full-rate production. This later category requires additional management attention. Management attention is also needed when the planned program quantities change significantly, which should result in a revised acquisition strategy that can impact LRIP quantities. Appendix H documents how the LRIP percentage of total planned buy has changed since Milestone II.

Variance in Planned Low-Rate Initial Production Quantities. In the programs in our audit, the LRIP quantities planned at Milestone II varied significantly during EMD and were different from all present LRIP quantities. These changes support the need for the milestone review to confirm LRIP quantities before entry into LRIP, as discussed in Finding A of this report, and the need to separately identify and manage LRIP quantity requirements. Specifically, all LRIP units in a program acquisition strategy approved at the Milestone II decision point and above the level certified by the Director, Operational Test and Evaluation, as necessary for IOT&E should be separately justified. The justification for these LRIP units should be based on the need to establish an initial production base for the system and permit an orderly increase in the production rate leading to full-rate production after completion of IOT&E, as specified in United States Code, title 10, section 2400. The justification for these additional LRIP quantities beyond IOT&E units should be reviewed and certified as part of the production readiness review required before entry into LRIP.

Using the production readiness review to ensure LRIP quantities are minimized provides for demonstrable compliance with the intent of United States Code, title 10, section 2400 and is consistent with the objectives of the reviews in DoD

Instruction 5000.2. In particular, DoD Instruction 5000.2 states that the production readiness reviews should, among other matters, address the cost-effectiveness of manufacturing plans, adequacy of production schedules, and consistency of plant facilities and manufacturing processes with production quantity and rate requirements.

The Army PLS program exemplifies a program with insufficient control over LRIP quantities. Both the LRIP and the full-rate production portions of the program were to be purchased under Contract DAAE07-90-C-R035. This contract was funded for a multi-year procurement of 2,691 trucks and related trailers during 5-program years. The contract did not put a cap on the number of trucks that could be produced during LRIP. Instead, the contract identified an LRIP production rate of 30 trucks per month. Because testing to establish the truck configuration baseline was not completed as scheduled and identified deficiencies were not corrected, we determined that:

o LRIP production quantities had been expanded, as of December 18, 1992, from 592 trucks to 777 trucks, an increase from 22 percent to 29 percent of the planned 2,691 truck buy; and

o The Government had only contingently accepted the 280 trucks delivered, as of November 30, 1992.

Under the terms of the PLS contract, LRIP production of 30 trucks per month could be continued as long as production qualification testing is incomplete and delivery and full Government acceptance of the 489th truck has not occurred. Without a cap on the LRIP quantities, the Army could complete production of all 2,691 trucks without a full-rate production decision.

Our review of the Air Force MILSTAR Terminal program showed how approved LRIP quantities can become impractical because of program reductions. When the USD(A) issued a memorandum June 18, 1990, authorizing the Air Force to extend the LRIP program by 2 years and to increase the original LRIP quantities from 51 to 136 terminals, a total buy of 988 terminals was planned. After the LRIP extension, DoD made significant reductions in the terminal program as part of overall MILSTAR program restructuring. As a result of limited fund availability, only 43 terminals were purchased on LRIP contracts; the total planned command post terminal quantity has been reduced to * terminals.

Despite the program reductions, the June 1990 extension of LRIP authority to 136 terminals had not been rescinded. The award of a contract for the remaining * terminals was being managed by the Air Force as an LRIP "buy out," or completion of LRIP; in effect this award represented a production decision. As a result, the Air Force did not plan to complete IOT&E as required for a full-rate production and deployment decision until after awarding a contract for the remaining terminals. This situation was addressed in our Audit Report No. 93-084. (See Appendix D).

* Predecisional data removed.

LRIP Quantity Guidelines. No formal guidelines existed concerning the acceptable quantity ratio for LRIP versus the total planned procurement. We found several LRIP "rules of thumb" that defined between 10 and 20 percent of the total planned quantity as acceptable for LRIP. * * * We did not identify an "ideal" means to determine LRIP quantities but consider identification of the factors in determining LRIP quantities essential to properly structuring LRIP programs. While a fixed-standard percentage or number of units is not advisable, we also believe separate quantification and justification of the number of units required for completing IOT&E, establishing a production base, and ramping up to full-rate production would improve the LRIP planning and have the impact of minimizing LRIP quantities.

Effect of Proceeding with Low-Rate Initial Production. Programs that continue production of systems without assurance that the design is stable, potentially operationally acceptable, and capable of being produced efficiently, risk over-commitment to production. Since the systems have not proved their technical and operational suitability, the Government then risks three undesirable options, when there are problems with the production units:

- o Retrofitting of low-rate initial production articles to make them work properly;
- o Accepting systems that do not fully meet mission requirements; or
- o Cancelling systems after large expenditures for production.

Developmental and operational testing and technical reviews cannot achieve the goal of reducing risk by early identification and correction of deficiencies and providing support to program production decisions when low-rate initial production decisions continue unaffected by test results. Additionally, the tests and reviews can be negatively impacted by efforts to proceed with low-rate initial production contracts when such efforts require disruption or modification of the content and schedules of these activities.

Conclusions

We believe that additional management attention is necessary to adequately ensure risks and benefits of low-rate initial production are adequately considered before LRIP decisions are made. Production decisions cannot normally be justified when unresolved design issues and incomplete testing, design, and production documentation exist. Therefore, we believe Service Acquisition Executives should be required to request a program waiver whenever production authority is sought for a major Defense acquisition program before all requirements for proceeding with the low-rate initial production decision in the approved acquisition strategy have been met.

* Predecisional data removed.

We also believe that tighter controls are needed over LRIP quantities to minimize overcommitment to production. We have observed a continuing pattern of programs being allowed to enter LRIP before completing prerequisites (Finding A), then having to issue multiple LRIP awards to keep production lines running while necessary development and design work continue. We also noted that, because of the lessening threat and tight budgetary constraints, programs have significantly cut back on planned total buys. The combination of extended LRIP production and reduced overall buys increases the risk of overcommitment to production. In addition to separate identification, documentation, and approval of LRIP quantities needed for testing and production considerations, we believe that cost and benefits of a break in production versus continued annual LRIP buys should be assessed by the milestone decision authority before entry into LRIP to limit LRIP quantities to the minimum necessary.

Recommendations, Management Comments, and Audit Response

We recommend that the Under Secretary of Defense for Acquisition revise DoD Instruction 5000.2 concerning major Defense acquisition programs to:

1. Require that the minimum low-rate initial production quantities necessary for initial operational test and evaluation, establishment of a production base, and orderly increase to a full-rate production be separately identified, documented, and approved by the milestone decision authority at the Milestone II, Developmental Approval, decision point and reaffirmed before entry into low-rate initial production.

2. Review low-rate initial production quantities in the guidelines for production readiness reviews and require certification as a result of the review of the minimum low-rate initial production quantity.

3. Require that the cost and benefits of a break in production versus annual low-rate initial production buys be assessed by the milestone decision authority before entry into low-rate initial production to limit low-rate initial production quantities to the minimum necessary while providing production units for operational test and evaluation.

4. Require Service Acquisition Executives to request a program-specific waiver from the Under Secretary of Defense for Acquisition before award of low-rate initial production contracts whenever testing and review prerequisites in DoD regulations and the approved acquisition strategy are deleted, modified, or not met.

Management Comments. The Director, Acquisition Program Integration, responded for the Under Secretary of Defense for Acquisition. The Director stated that, in general, he was supportive of the finding and recommendations. The Director concurred with Recommendation B.3. and partially concurred with Recommendation B.2. The Director nonconcurred with Recommendations B.1. and B.4.

Full text of the comments is in Part IV.

Regarding Recommendation B.1., the Director stated that revision to DoD Instruction 5000.2 policy is not necessary because the Instruction already requires definition of minimum LRIP quantities for IOT&E, initial production base, and orderly increase to full-rate production.

Regarding Recommendation B.2., the Director agreed to include review of LRIP quantities in the DoD Instruction 5000.2 guidelines for PRRs but did not believe that a requirement for certification of minimum LRIP quantities as a result of the review was necessary.

Regarding Recommendation B.3., the Director agreed to revise DoD Instruction 5000.2 to require milestone decision authorities to assess the costs and benefits of a break in production versus continued annual LRIP buys before programs enter LRIP.

Regarding Recommendation B.4., the Director nonconcurred with revising DoD Instruction 5000.2 to require Service Acquisition Executives to request program-specific waivers before contract award when LRIP requirements are not met. The Director stated that the other recommendations in Findings A. and B. will be adequate corrective action.

Audit Response.

o Concerning the Director, Acquisition Program Integration, response to Recommendation B.1., we do not agree that current DoD Instruction 5000.2 policy provides for separate identification, documentation, and approval of the number of LRIP units required to complete IOT&E, establish an production base, and ramp up to full-rate production. The Instruction provides only for consideration of these three components of LRIP to derive an overall LRIP amount. In addition, management comments do not address our recommendation for reaffirmation of the LRIP quantity before actual entry into LRIP. We believe that the combination of separate identification, documentation, and approval of the three components of LRIP and reaffirmation of these quantities before entering LRIP would provide an essential control technique for minimizing LRIP quantities. As discussed in our report, many changes, such as budget reductions, test and delivery schedule slippages, and reassessment of the threat can occur between the Milestone II decision and entry into LRIP that would cause a need to reevaluate the previously approved quality/rate. LRIP reaffirmation of quantities provides the opportunity to determine whether the planned LRIP quantity is still the minimum necessary to achieve program production goals. Separate identification of the testing, production base, and ramp up components of the LRIP quantity will provide

documentation concerning the assumptions behind the derivation of each component quantity. Changes that occur in the program can then be assessed, as part of the reaffirmation of the overall LRIP quantity, for their impact on each LRIP component quantity. We ask management to reconsider its position on separate identification, documentation, and approval of LRIP quantities and to provide a position on reaffirmation of LRIP quantities before Milestone II.

o Concerning the response to Recommendation B.2., we agree with management's plan to include review of LRIP quantities into the guidelines for PRRs but do not agree with the assertion that certification of the quantities is not necessary. We believe certification of LRIP quantities would provide additional focus on minimizing the LRIP quantity, which we consider a critical production issue. As a matter of clarification, the certification requirement could be met by the PRR revalidating the LRIP quantities, and for Major Defense Acquisition Programs that revalidation could be accepted as part of the Production Readiness Assessment provided to the DAB. We ask management to reconsider its position on certification of LRIP quantities as part of PRRs and to provide an estimated date for completing the revision of the DoD Instruction 5000.2.

o Concerning the response to Recommendation B.3., management's comments are responsive to the intent of the recommendation but provided no estimated date for accomplishment of the revision to DoD Instruction 5000.2. We ask that management provide an estimated date for completing revision of the Instruction.

o Concerning the response to Recommendation B.4., we disagree that revision of DoD Instruction 5000.2 to require Service Acquisition Executives to request waivers before contract award when LRIP requirements are not met is not necessary because of the other recommendations in Findings A. and B. Our disagreement is based on management's nonconcurence with the following provisions of the subject recommendations: establishment of a separate acquisition milestone for LRIP and provision of engineering and manufacturing development models for operational assessment before commitment of long-lead procurement funding for LRIP. We believe that the waiver of LRIP requirements should be addressed in the Acquisition Decision Memorandum resulting from the LRIP milestone review. We ask that management reconsider its position on the requirement for waivers when required accomplishments for LRIP are not met.

Other Management Comments and Audit Response to the Comments

The Army Director for Combat Services Support disagreed with information presented in the finding. He stated that our statements concerning PLS LRIP quantities were misleading because they imply that costs and risks for corrective actions on the trucks fall on the Army.

Our statements concerning PLS LRIP quantities were made in the context of an example of the need for improving controls over LRIP quantities to ensure that these quantities are only the minimum required for testing, establishment of a production base, and orderly increase to full-rate production. As explained in the finding, the terms of the PLS contract made it possible for the Army to complete production of the entire PLS buy without having a Milestone III, Production Approval, decision.

Based on clarifying information in the Army response we changed the following information in Finding B:

o We provided a footnote to Appendix G that explains that individual years of LRIP production were awarded as part of a 5-year multi-year contract that encompassed both LRIP and full-rate production.

o We changed footnote 1 in Appendix H to explain that the requirement to specify LRIP quantities became effective with the Fiscal Year 1990 Defense Authorization Act.

The full text of the Army comments is in Part IV.

The Deputy Assistant Secretary of the Air Force for Acquisition disagreed with information provided in the finding, which was based on audit results documented in Report No. 93-084. The Deputy Assistant Secretary disagreed with our assertions that LRIP was not used to adequately control program risk in transitioning to Milestone III, Production Approval, and that the purchase of the remaining terminals * should be treated as a Milestone III decision since it would complete the terminal buy.

We completed resolution of outstanding issues on Report No. 93-084, on August 30, 1993. In this earlier report, we recommended that USD(A) require that a Defense Acquisition Board Milestone III Production Approval Review, supported by operational testing of terminals with a MILSTAR satellite, be conducted before completion of the planned terminal procurement. Although the recommendation was not implemented, the final terminal buy was reduced from the * terminals shown in Report No. 93-084 to 38 terminals. While we continue to believe that terminal procurement is being completed without accomplishing prerequisites in design, testing, and production, we did not seek mediation of this issue because we also believe that the risk of this acquisition has been partially mitigated by the reduction in the terminal buy.

The full text of the Air Force comments is in Part IV.

* Predecisional data removed.

Part III - Additional Information

Appendix A. Statutes Related to Low-Rate Initial Production

United States Code, title 10, section	Statute Excerpt
138	(a)(2) In this section: (A) The term "operational test and evaluation" means-- (i) the field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users; and (ii) the evaluation of the results of such test. (B) The term "major defense acquisition program" means a Department of Defense acquisition program that is a major defense acquisition program for purposes of section 2430 of this title or that is designated as such a program by the Director for purposes of this section.
2302	(a)(5) The term "major system" means a combination of elements that will function together to produce the capabilities required to fulfill a mission need. The elements may include hardware, equipment, software, or any combination thereof, but excludes construction or other improvements to real property. A system may be considered a major system if--

United States Code, title 10, section	Statute Excerpt
2302 (continued)	(A) the Department of Defense is responsible for the system and the total expenditures for research, development, test, and evaluation for the system are estimated to be more than $75,000,000 (based on fiscal year 1980 constant dollars) or the eventual total expenditure for procurement of more than $300,000,000 based on 1980 constant dollars); or (C) the system is designated a "major system" by the head of the agency responsible for the system.
2399	(a) Condition for proceeding beyond low-rate initial production. (1) The Secretary of Defense shall provide that a major defense acquisition program may not proceed beyond low-rate initial production until initial operational test and evaluation of the program is completed. (2) In this subsection, the term "major defense acquisition program" means-- (A) a conventional weapons system that is a major system within the meaning of that term in section 2302(5) of this title; and (B) is designed for use in combat. (b) Operational test and evaluation. (1) Operational testing of a major defense acquisition program may not be conducted until the Director of Operational Test and Evaluation of the Department of Defense approves (in writing) the adequacy of the plans (including the projected level of funding) for operational test and evaluation to be conducted in connection with that program.

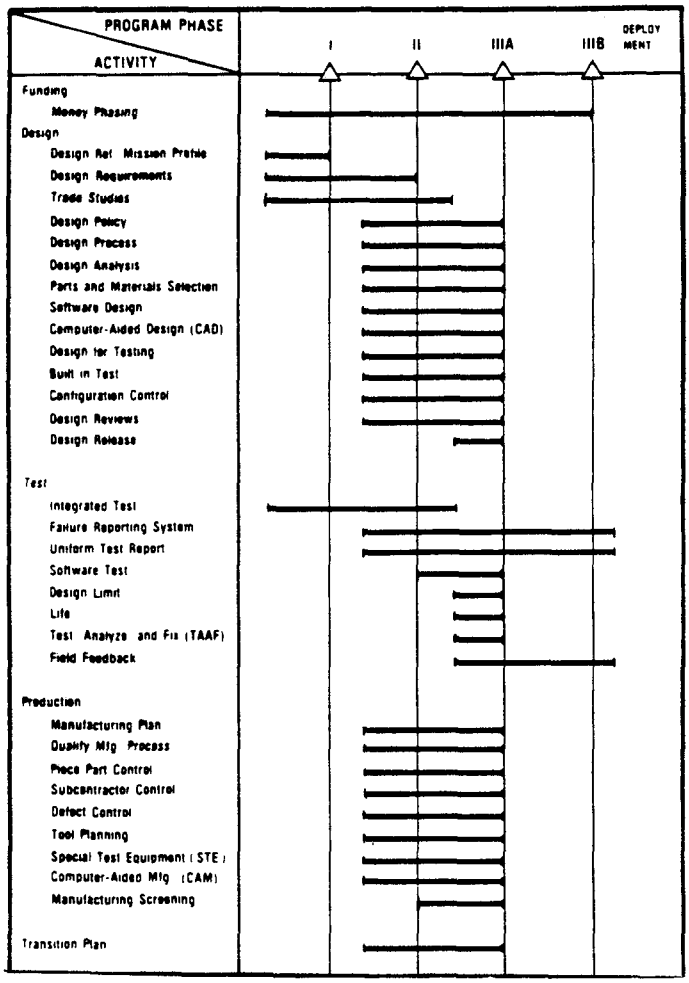
United States Code, title 10, section	Statute Excerpt
2399 (continued)	(2) The Director shall analyze the results of the operational test and evaluation conducted for each major defense acquisition program. At the conclusion of such testing, the Director shall prepare a report stating the opinion of the Director as to--
2399	(A) whether the test and evaluation performed were adequate; and (B) whether the results of such test and evaluation confirm that the items or components actually tested are effective and suitable for combat. (3) The Director shall submit each report under paragraph (2) to the Secretary of Defense, the Under Secretary of Defense for Acquisition, and the congressional defense committees. Each such report shall be submitted to those committees in precisely the same form and with precisely the same content as the report originally was submitted to the Secretary and Under Secretary and shall be accompanied by such comments as the Secretary may wish to make on the report. (4) A final decision within the Department of Defense to proceed with a major defense acquisition program beyond low-rate initial production may not be made until the Director has submitted to the Secretary of Defense the report with respect to that program under paragraph (2) and the congressional defense committees have received that report. (5) In this subsection, the term "major defense acquisition program" has the meaning given that term in section 138(a)(2)(B) of this title.

United States Code, title 10, section	Statute Excerpt
2399 (continued)	(c) Determination of quantity of articles required for operational testing. The quantity of articles of a new system that are to be procured for operational testing shall be determined by-- (1) the Director of Operational Test and Evaluation of the Department of Defense, in the case of a new system that is a major defense acquisition program (as defined in section 138(a)(2)(B) of this title); or (2) the operational test and evaluation agency of the military department concerned, in the case of a new system that is not a major defense acquisition program. (h) Definitions. In this section: (1) The term "operational test and evaluation" has the meaning given that term in section 138(a)(2)(A) of this title. For purposes of subsection (a), that term does not include an operational assessment based exclusively on-- (A) computer modeling; (B) simulation; or (C) an analysis of system requirements, engineering proposals, design specifications, or any other information contained in program documents. (2) The term "congressional defense committees" means the Committees on Armed Services and the Committee on Appropriations of the Senate and House of Representatives. (Added Pub.L. 101-189, Div. A, Title VIII, § 802(a)(1), Nov. 29, 1989, 103 Stat. 1484.)

United States Code, title 10, section	Statute Excerpt
2430	Major Defense acquisition program defined. In this chapter, the term "major defense acquisition program" means a Department of Defense acquisition program that is not a highly sensitive classified program (as determined by the Secretary of Defense) and-- (1) that is designated by the Secretary of Defense as a major defense acquisition program; or (2) that is estimated by the Secretary of Defense to require an eventual total expenditure for research, development, test, and evaluation of more than $200,000,000 (based on fiscal year 1980 constant dollars) or an eventual total expenditure for procurement of more than $1,000,000,000 (based on fiscal year 1980 constant dollars).

Appendix B. Low-Rate Initial Production Guidance

DoD 4245.7-M, "Transition from Development to Production": The Manual, issued in September 1985, provides assistance in structuring technically sound programs, assessing their risk, and identifying areas needing corrective action. The assistance is provided in a series of descriptive templates; each template discusses an area of risk and then provides methods for reducing that risk. The templates are based on lessons learned from analysis of programs. The DoD 4245.7-M is designed to provide a disciplined approach to the acquisition process that will help make decisions for ongoing programs.



Timelines*

Program risk is introduced when a particular activity is started late or continues beyond the timeline.

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Points I and II on the table timeline are the milestones now referred to in DoDI 5000.2, "Defense Acquisition Management Policies and Procedures," as "Concept Demonstration Approval" and "Development Approval," respectively. Point IIIA represents the decision to begin LRIP, not recognized as a separate acquisition milestone in DoDI 5000.2; point IIIB represents the Milestone III, Production Approval.

Start and completion of design, test, and production of the activities listed in the table are given in relationship to acquisition milestones. The manual states that program risk is introduced when a particular activity is started late or continues beyond the timeline. The table provides that, for minimized program risk, 28 of the 31 activities (90 percent) identified under "Design," "Testing," and "Production" be completed before the LRIP decision.

In addition to the individual activity templates and activity time phasing, the manual provides significant insights concerning the design, test, and production efforts necessary to make a successful transition from development to production:

o Design: High risk of failure for Government acquisition programs occurs at the outset of the design process. While some risk associated with a new technical concept may be unavoidable, this risk has been magnified by the misunderstanding of the industrial design processes necessary to turn a concept into a mature product. The templates dealing with design address the many engineering disciplines which must be applied to reduce program risk, including disciplines that ensure the ability of parts to endure stress, which have historically been underemphasized.

o Testing: As the system design matures, complex testing is needed to provide confidence that the system will perform satisfactorily in the operational environment. The testing-related templates are based on test and evaluation experience of major DoD programs and the contributions of testing efforts toward reducing program risk. Attention is given to topics such as integrated test plans; operational test environments; reliability development tests; reliability demonstration tests; software tests; full-scale engineering development tests; initial operational test and evaluation; and applying the process of testing, analyzing failures, and implementing fixes. The guidance in the templates addresses significant testing concerns requiring management attention to reduce the risk of transition from development to production.

o Production: Solving the manufacturing portion of the acquisition equation is a major factor in reducing the risk of transitioning to production. The history of military procurements includes many cases of proven functional designs being introduced into the manufacturing process, only to complete that process as end products that cannot support their mission requirements. The templates provide guidance for early and effective planning in areas that have been troublesome. Guidance covers subjects such as manufacturing plans and processes, quality control, subcontractor control, tool planning, special test equipment, computer-aided manufacturing, and manufacturing screening.

Military Standard 1521-B, "Technical Reviews and Audits for Systems, Equipments, and Computer Software": The Military Standard, issued June 4, 1985, identifies requirements for technical reviews and audits which occur throughout the acquisition process. The specific reviews and audits that normally occur before the LRIP decision and their role in providing feedback concerning program risk include:

o Critical Design Review: This review is conducted for each configuration item of a system when the detail design is essentially complete. The purpose of this review is to:

o Determine that the detail design of the configuration item reviewed satisfies the performance and engineering specialty requirements of the development specification;

o Establish the detail design compatibility among the configuration item and other items of equipment, facilities, computer software, and personnel;

o Assess configuration item risk areas (on a technical, cost, and schedule basis);

o Assess the results of the producibility analyses on system hardware;

o Review the preliminary hardware product specifications; and

o Determine, for software items, the acceptability of the detailed design, performance, and test characteristics of the design solution and the adequacy of the operation and support documents.

o Test Readiness Review: This review for each system software configuration item determines whether the software test procedures are complete and ensures that the contractor is ready for formal software testing. The review also includes assessment of the results of informal software testing and updates to the operational support documents. A successful test readiness review is predicated on the contracting agency's determination that the software test procedures and informal test results form a basis for proceeding into formal software testing.

o Production Readiness Review: This review determines the status of completion of the specific actions that must be satisfactorily accomplished before a production go-ahead decision. The review is accomplished incrementally during Phase II, Engineering and Manufacturing Development. Incremental reviews are to be at least annually and before the Milestone III Production Approval Review. In the earlier stages, the review covers gross-level manufacturing concerns such as the need for identifying high-risk and low-yield manufacturing processes or materials or the requirement for manufacturing development effort to satisfy design requirements. The reviews become more refined as the design matures, dealing with concerns such as production planning, facilities allocation, incorporation of producibility-oriented changes, identification and fabrication of tools and test equipment, and long-lead item acquisition.

o Functional Configuration Audit: The objective of this audit is to verify that the configuration item's actual performance complies with its hardware development or software requirements and interface requirements

specifications. Test data is reviewed to ensure that the computer hardware or software performs as required. The functional configuration audit should be conducted on configuration of the item that is representative of the configuration to be released for production of the operational inventory quantities.

o Physical Configuration Audit: This audit is the formal examination of the as-built version of a configuration item against its design documentation to establish the product baseline. The audit includes detailed assessment of engineering drawings, specifications, technical data, and tests used in production of hardware items and design documentation. For software items, listings and manuals are also examined.

Appendix C. Prior Audits and Other Reviews

Office of the Inspector General, Department of Defense

Report No. 92-089, "Cost-Effectiveness Analysis for the Air Force C-17 Program," May 12, 1992, found that the Air Force was overly committed to production before the Milestone III review since 28 percent of the total planned aircraft buy would already be on contract when the review was held. We recommended that a Cost and Operational Effectiveness Analysis be performed and a special Defense Acquisition Board program review of the C-17 Program be conducted before the Lot V production decision. USD(A) responded that an appropriate amount of C-17 review occurred, and an additional Defense Acquisition Board before Milestone IIIB is not required. USD(A) also responded that an additional Cost and Operational Effectiveness Analysis beyond current efforts is not required.

Report No. 92-064, "Titan IV Program," March 31, 1992, found that organizations responsible for paying progress payments did so without regard to how the costs were incurred relative to the type of appropriated funds. We recommended that the Director of Defense Procurement issue policy guidance requiring that multi-funded contracts include provisions to segregate progress payment requests by appropriation and that the DoD Comptroller review accounting policies and procedures for all Military Departments to ensure that adequate oversight and control of expenditures related to progress payments are implemented and maintained as required by DoD 7220.9-M. Additionally, we recommended that the Program Executive Officer direct the Titan IV Procurement Contracting Officer to request the contractor provide back-up information to progress payment requests that categorizes costs incurred by type of appropriation.

Report No. 92-050, "Review of the Sensor Fuzed Weapon as a Part of the Audit of the Effectiveness of the Defense Acquisition Board Review Process," February 18, 1992, found that program-specific exit criteria were not established for proceeding to future production decisions. As a result, management did not have an effective means of measuring progress or justifying production decisions. We recommended the establishment of specific exit criteria for future SFW production decisions. The USD(A) concurred and stated that program-specific criteria were established for the low-rate initial production decision, which was made at the Defense Acquisition Board review. Proposed exit criteria for the full-rate production decision were discussed and established for the milestone planned for FY 1995.

Report No. 91-125, "Waivers and Deviations to Contracts for the Airborne Self-Protection Jammer Program," September 30, 1991, disclosed that a planned award of 46 ASPJ units on an additional LRIP contract was not justified

based on drastic reductions in the planned total buy. We recommended that no further ASPJ contracts be awarded until completion of operational test and evaluation. The USD(A) generally concurred but determined that one additional low-rate production award was necessary to maintain the mobilization base.

Report No. 91-007, "Selected Acquisition Actions on the C-17 Aircraft," November 2, 1990, found that the Air Force System Program Office exercised the FY 1989 contract option to buy four production C-17 aircraft before Douglas Aircraft Company completed the required CDR of all mission computer software. The C-17 Program Director considered the Mission Computer CDR, done in 1989, to be adequate and complete, even though Douglas had completed the detail design for only about 60 percent of all software in the mission computer. We recommended that the Air Force amend the C-17 full-scale development contract to require completion of the software design review of the mission computer software as a precondition to awarding the Lot III production contract to procure four aircraft for FY 1990. The Air Force Deputy Assistant Secretary (Acquisition) nonconcurred with the recommendation and stated that Douglas met all requirements of the CDR and that Douglas considered the CDR to be completed.

Report No. 90-066, "Hotline Allegations Regarding the Milestone IIIA Production Decision for the Airborne Self-Protection Jammer Program," May 10, 1990, concluded that the acquisition plan for the ASPJ program provided for the Navy to proceed with extensive production of the ASPJ units before testing would determine whether production-representative ASPJ units would be effective in their intended environment. The ASPJ Acquisition Review Board inappropriately influenced decisionmakers by directing testers to present favorable test results. The report recommended that the Navy renegotiate the delivery schedule for Lot I production contracts. The report also recommended that the USD(A) defer the two interim Milestone IIIA Defense Acquisition Board reviews until operational test and evaluation confirms the effectiveness of the ASPJ and reemphasized to acquisition managers the importance of independent test and evaluation efforts. Management generally nonconcurred with the recommendations.

Report No. 89-104, "Acquisition of the MK-50 Torpedo Program," August 29, 1989, found that senior Navy and DoD decisionmakers did not have a full and objective view of the program's status before transition into LRIP. We found significant scope imitations to operational testing and reported test results that showed that the program achieved more favorable results than were actually demonstrated. We recommended that the MK-50 program not be allowed to go beyond LRIP before it demonstrated operational effectiveness against a target.

Report No. 89-075, "Quick-Reaction Report on Operational Testing for the Single Channel Ground and Airborne Radio System (SINCGARS)," May 6, 1989, found that the Army was planning to approve full-rate production even though the program lacked the required operational testing to proceed beyond LRIP. We recommended that the USD(A) and the Director, Operational Test and Evaluation, comply with the United States Code, title 10 regarding operational testing and evaluation being completed and properly reported before

the Army is allowed to award option three (full-rate production) of the Single Channel Ground and Airborne Radio System contract. The USD(A) and Director, Operational Test and Evaluation, nonconcurred with the recommendations.

General Accounting Office

Report No. GAO/NSIAD-93-16, "Military Communications Joint Tactical Information System Issues," November 12, 1992, revealed that the number of JTIDS' operating hours were insufficient to establish confidence in test results; therefore, an adequate assessment of the terminals could not be made. Despite these unsatisfactory test and assessment results and a recommendation by DoD's operational testing staff to delay production, the USD(A) approved LRIP in October 1989.

Report No. GAO/NSIAD-93-15, "Weapons Acquisition: A Rare Opportunity for Lasting Change," December 1992, summarized the major acquisition issues addressed by GAO over the past 15 years. The report concluded that weapon systems have historically begun production too quickly and were fielded with major unknown or unresolved problems. The report made no formal recommendations but concluded that pertinent considerations for acquisition programs include whether the acquisition strategy is reasonable, whether the system performs effectively, and whether the system is suitable for production and fielding.

Report No. GAO/NSIAD-92-103, "Electronic Warfare: Established Criteria Not Met for Airborne Self-Protection Jammer Production," March 23, 1992, revealed that after system failures began during the reliability growth testing, the Navy changed the criterion to exclude the system failures attributable to software errors. With the software-induced failures excluded, ASPJ was said to have met the reliability growth criterion. As a result, the Navy circumvented DoD's testing standards and failed to recognize the adverse impacts of software problems experienced with other electronic warfare systems similar to ASPJ. Moreover, results of additional reliability growth testing conducted after the Defense Acquisition Board allowed the program to proceed shows that ASPJ's software problems are continuing. The GAO recommended Congress oppose further production contracts until operational tests, scheduled for completion in fiscal year 1992, demonstrated that ASPJ will successfully perform its mission. DoD officials responded that, although software-induced failures were excluded from the scoring, these failures had not been ignored in the decision to approve Lot II production. Officials said that other tests conducted outside of the reliability growth test program, including developmental flight tests and contractor tests using modified software, had provided reasonable assurance that the software problems had been corrected.

Report No. GAO/T-NSIAD-90-43 (OSD Case No. 8341-A), "Weapons Systems: Concurrency in the Acquisition Process, Statement of Frank C. Conahan, Assistant Comptroller General, National Security and International

Affairs Division, before the Committee on Armed Services, United States Senate," May 17, 1990, revealed that DoD's current acquisition strategy, allowing production before successful completion of critical tests, has resulted in systems that did not perform as intended. Mr. Conahan stated that the Services generally were not conducting or planning operational testing on weapon systems until after production started. Six weapon systems were reviewed and, in four cases, planned operational testing lagged behind the actual or planned initial production decision by 1 to 3 years.

Report No. GAO/NSIAD-90-28, "Military Satellite Communications: Issues Associated With DoD's MILSTAR Terminal Program," May 23, 1990, concluded that the decision authorizing the Air Force to proceed into LRIP was based on less test data than originally planned, thus increasing the risk that design changes would occur. GAO recommended that the Air Force use production-representative terminals to perform operational testing before the Defense Acquisition Board made the full-rate production decision. DoD agreed, stating that the issues identified would be examined by the Defense Acquisition Board during its full-rate production review.

Report No. GAO/NSIAD-89-98, "Navy Weapons Testing: Defense Policy on Early Operational Testing," May 8, 1989, concluded that Navy typically proceeded to full-scale development, and often LRIP, before any Operational Test and Evaluation was completed. The GAO recommended that the Secretary of Defense reemphasize the desirability of performing Operational Test and Evaluation as early as possible in the acquisition cycle, as in DoD's acquisition directives. The GAO also recommended the Secretary clarify when decision-makers may rely on operational assessments that may not include the operational testing of any hardware and when actual operational testing and evaluation must occur.

Appendix D. Inspector General, DoD, Reports and Memorandum Issued as a Result of This Audit

Report No. 93-084, "Air Force Military Strategic and Tactical Relay Satellite Terminal Program," April 13, 1993, revealed that the program was not ready to begin production and deployment in March 1993. Specifically, the Air Force had proceeded to a production decision for * command post terminals, expected to cost * without completing the prerequisites in testing, design, and production. As a result the Air Force risked premature commitment to completing the production of the command post terminal and potential misuse of funds in violation of law. We recommended a Defense Acquisition Board Milestone III Production and Deployment Review and Defense Acquisition Executive approval before award of a contract for completion of planned command post terminal production. We also recommended that specific exit criteria, addressing terminal performance, be established for the program to enter full production. In addition we found that progress payments were made from both Research and Development and Procurement funding obligated on the low-rate initial production contracts without regard to the amount of each type of work that had actually been performed. We recommended implementation of procedures to ensure adequate internal controls over appropriations and implementation of controls on LRIP contracts to categorize costs properly and ensure proper use of appropriated funds. A similar finding on making progress payments without matching work performed to the proper type of appropriated funds can be found in the synopsis of the Office of the Inspector General, Department of Defense, Report No. 92-064, "Titan IV Program," March 31, 1992, included in Appendix D.

Report No. 93-039, "Low-Rate Initial Production of the EA-6B Program," December 18, 1992, revealed that the program was to enter LRIP without completing the prerequisites in design, testing, and preparation for production and that the program was being managed as three separate segments rather than as a single major Defense acquisition program. Also, we found that testing to determine the operational suitability and effectiveness of aircraft manufactured during LRIP would not occur until after the Milestone III Production Approval. In addition, procurement funding, appropriated for the EA-6B, was being used to fund development efforts. We recommended that the LRIP for the EA-6B aircraft be postponed and made contingent on specific exit criteria and that program segments be combined and managed as a single major Defense acquisition program. We also recommended that the results of operational test and evaluation of production representative aircraft be in the Milestone III review. Additionally, we recommended that the program comply with United States Code, title 31, sec. 1301 and sec. 1341, regarding the use of appropriated funds for their intended purpose. The USD(A) planned corrective actions that met the intent of all of our recommendations.

* Predecisional data removed.

Quick-Reaction Memorandum, "Army Palletized Load System," sent to the Under Secretary of Defense for Acquisition on December 11, 1992, stated that the Army was prematurely proceeding to a Milestone III, Production Approval Review. We recommended that the Army complete additional operational testing to verify that the system can meet the Acquisition Program Baseline performance thresholds before proceeding to full-rate production. The Under Secretary of the Army for Research and Development met with the Director, Operational Test and Evaluation's independent evaluators and recommended, based on Director, Operational Test and Evaluation, input and our memo, that full production be delayed on the PLS system until the Army completes additional testing to resolve these issues.

Appendix E. Summary of Program Deficiencies in the Transition to Low-Rate Initial Production

	PLS	MK-50[1]	EA-6B	MILSTAR	ASPJ	C-17	JTIDS
Acquisition Strategy							
- Exit criteria							
-- Not adequate or not program-specific		X	X				
-- Not adhered to	X	X			X		
- Low-Rate Initial Production unsupported by program accomplishments	X	X	X	X	X	X	X
Design							
- Incomplete reviews							
-- Critical Design Reviews			X			X	
-- Test Readiness Reviews			X				
- Unresolved design problems	X	X	X	X	X	X	
Testing[2]							
-Developmental Testing							
-- Unresolved deficiencies	X	X	X		X		
-- Reduced or limited testing	X		X	X	X		
- Limited Operational Assessments		X	X		X		X
Production Preparation							
- Production Readiness Reviews							
-- Reviews not performed	X	X	X				
-- Reviews limited in coverage			X				

[1] The deficiencies were noted on this program before funding was cancelled.
[2] Incomplete testing also indicates potential design instability, since design changes are often driven by test results.

Appendix E. Summary of Program Deficiencies in the Transition to Low-Rate Initial Production

	PLS	MK-50[1]	EA-6B	MILSTAR	ASPJ	C-17	JTIDS
- Engineering Models							
-- Delivery schedule slippages		X	X	X	X	X	
-- Incomplete or did not meet contract specifications			X	X	X	X	
Internal Controls							
- Inadequate control of appropriations			X	X		X	
- Controls not followed	X	X	X	X	X	X	X

[1] The deficiencies were noted on this program before funding was cancelled.

Appendix F. Proposed Low-Rate Initial Production Milestone Documentation Requirements[1]

Operational Requirements Document
System Threat Assessment Report
Defense Intelligence Agency Intelligence Report[2]
Joint Requirements Oversight Council Assessment[2]
Integrated Program Summary
Integrated Program Assessment
Program Life-Cycle Cost Estimate
Acquisition Program Baseline Agreement[3]
Manpower Estimate Report
Test and Evaluation Master Plan
Developmental Test and Evaluation Report
Independent Cost Estimate
Independent Cost-Estimate Report
Cost and Operational Effectiveness Analysis
Early Operational Assessment Report (should include results of some early initial operational test and evaluation)

[1] With exception of the Developmental Test and Evaluation Report and the Early Operational Assessment, documentation requirements would be limited to any updates required to account for changes occuring since Milestone II approval.

[2] DoD Instruction 5000.2 requires these documents for Acquisition Category 1D programs only.

[3] The continued viability of performance, schedule, and cost objectives and threshold provided in the Baseline set at Milestone II should be assessed and adjusted as necessary. Baseline schedule dates proceeding the Milestone II, Production Approval, should include "date complete" for functional and physical Configuration Audits and for final (before full-rate) Production Readiness Review; "Date of Delivery" for first LRIP Unit; and Start/Complete dates for IOT&E.

Appendix G. Multiple Annual Low-Rate Initial Production Contracts Awarded or Planned

Program	1988	1989	1990	1991	1992	1993	1994
C-17 Aircraft	X	X		X	X	X	
Joint Tactical Information Distribution System			X	X	X		
MK-50 Torpedo	X		X	X	X		
Palletized Load System			X*	X*	X*	X*	
Sensor Fuzed Weapon System					X	X	X

* Four individual production years for PLS were awarded as part of a five year multi-year contract that encompassed both LRIP (1990-1993) and full-rate production.

Appendix H. Low-Rate Initial Production as a Percentage of Total Planned Production

Program	Total Quantities Planned at Milestone II Total Buy	LRIP	Total Quantities Planned as of December 1992 Total Buy	LRIP	LRIP Percent of the Planned Total Buy at Milestone II	LRIP Percent of the Planned Total Buy as of December 1992
ASPJ	533	0[1]	739	136	0	18
SFW	14,000	1,080	10,000	2,022	8	20
C-17	210	0[1]	120	28	0	23
PLS	4,333	0[1]	2,691	777	0	29
EA-6B	102	21	102	15	21	15
MILSTAR	988	51	*	*	5	100[2]
MK-50	C[3]	436	C[3]	851	N/A	N/A
JTIDS	1,179	278	971	166	24	17

[1] The requirement to specify LRIP requirement began with the fiscal year 1990 Defense Authorization Act.
[2] Total buy was being executed under LRIP authority.
[3] Total quantities are classified (C).
* Predecisional data removed.

Appendix I. Summary of Potential Benefits Resulting From Audit

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
A.1.a.	Internal Control. Will ensure that LRIP begins after the milestone decision authority has fully assessed the required LRIP quantities and the attainment of required program accomplishments and exit criteria.	Nonmonetary.
A.1.b.	Internal Control. Will provide guidance on minimum accomplishments programs must meet before commiting resources for LRIP.	Nonmonetary.
A.1.c.	Internal Control. Will ensure that acquisition decisions are based on specific program accomplishments.	Nonmonetary.
A.1.d.	Internal Control. Will ensure that operational assessments of engineering development models can be performed before committing long-lead procurement funding for LRIP.	Nonmonetary.
A.2.	Internal Control. Will provide direct linkage between systems engineering requirements and low-rate initial and full-rate production decisions.	Nonmonetary.
B.1. and B.2.	Compliance with Public Law and Internal Control. Will ensure that LRIP quantities are limited to the minimum necessary to support operational testing and production considerations.	Undeterminable. Amount will vary with each program and benefits will continue as new programs define LRIP quantities.

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
B.3.	Internal Controls. Will ensure that cost and benefits of a production line break are fully considered as an alternative to continued LRIP buys.	Undeterminable. Amount will vary with each program and benefits will continue as future programs perform the cost and benefits analysis.
B.4.	Internal Controls. Will ensure that low-rate initial production contracts are awarded only after all testing and review prerequisites have been met unless a specific waiver is provided.	Nonmonetary.

Appendix J. Activities Visited or Contacted

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition, Washington, DC
Assistant Secretary of Defense (Program Analysis and Evaluation), Washington, DC
Comptroller of the Department of Defense, Washington, DC
Director, Operational Test and Evaluation, Washington, DC

Department of the Army

Deputy Chief of Staff for Operations and Plans, Washington DC
Cost and Economic Analysis Center, Alexandria, VA
Materiel Systems Analysis Activity, U.S. Army Materiel Command, Aberdeen Proving Ground, MD
Operational Test and Evaluation Agency, Alexandria, VA
Program Executive Office, Combat Support, Warren, MI
Palletized Load System Program Office, Warren, MI

Department of the Navy

Assistant Secretary of the Navy (Research, Development and Acquisition), Washington, DC
Naval Command Control and Ocean Surveillance Center, San Diego, CA
Naval Operational Test and Evaluation Force, Norfolk, VA
Navy Program Executive Office, Surface Ship Anti-Submarine Warfare, Washington, DC
A-6/EA-6 Program Office, Naval Air Systems Command, Washington, DC
Joint Terminal Program Office, Washington, DC
MK-50 Torpedo Program Office, Naval Sea Systems Command, Washington, DC

Department of the Air Force

Assistant Secretary of the Air Force (Acquisition) Washington, DC
Air Force Program Executive Office, Space Programs, Washington, DC
Air Force Program Executive Office, Tactical Systems, Washington DC
Air Force Operational Test and Evaluation Center, Kirtland Air Force Base, New Mexico
Military Strategic and Tactical Relay Satellite Program Office, Space Systems Center, Los Angeles, CA

Department of the Air Force (Continued)

Military Strategic and Tactical Relay Terminal Satellite Program Office, Electronic Systems Center, Hanscom Air Force Base, MA

Other Defense Organizations

Defense Logistics Agency, Cameron Station, Alexandria, VA
Defense Contract Audit Agency, Raytheon Company, Burlington, MA
Defense Contract Management Administrative Office, Milwaukee, WI
Defense Plant Representative Office, Grumman Aerospace Corporation, Bethpage, NY
Defense Plant Representative Office, Oshkosh Truck Corporation, Oshkosh, WI
Defense Plant Representative Office, Raytheon Company, Burlington, MA
Defense Finance and Accounting Service, Columbus, OH

Non-Defense Activities

Grumman Aerospace Corporation, Bethpage, NY
Oshkosh Truck Corporation, Oshkosh, WI
Raytheon Company, Burlington, MA
Raytheon Company, Equipment Division, Satellite Terminal Systems Directorate, Marlborough, MA

Appendix K. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition
Director, Operational Test and Evaluation
Comptroller of the Department of Defense

Department of the Army

Secretary of the Army
Assistant Secretary of the Army (Research, Development, and Acquisition)
Auditor General, Department of the Army
Deputy Commanding General for Army Materiel Command
Program Manager, Palletized Loading System

Department of the Navy

Secretary of the Navy
Assistant Secretary of the Navy (Financial Management)
Assistant Secretary of the Navy (Research, Development and Acquisition)
Commander, Naval Air Systems Command
Commander, Naval Sea Systems Command
Auditor General, Naval Audit Service
Program Manager, Airborne Self-Protection Jammer
Program Manager, A-6/EA-6 Aircraft
Program Manager, MK-50 Torpedo

Department of the Air Force

Secretary of the Air Force
Assistant Secretary of the Air Force (Acquisition)
Assistant Secretary of the Air Force (Financial Management and Comptroller)
Commander, Air Force Materiel Command
Auditor General, Air Force Audit Agency
Program Executive Officer for Space Programs
Program Manager, C-17 System
Program Manager, Joint Tactical Information Distribution System
Program Manager, Military Strategic and Tactical Relay Satellite Systems Terminal
Program Manager, Sensor Fuzed Weapon

Defense Agencies

Director, Defense Contract Management Command
Director, Defense Logistics Agency
  Commander, Defense Contract Management Command
Director, Defense Finance and Accounting Service
Inspector General, Defense Intelligence Agency
Inspector General, National Security Agency
Director, Defense Logistics Studies Information Exchange

Non-Defense Federal Organizations

Office of Management and Budget
U.S. General Accounting Office, National Security and International Affairs Division, Technical Information Center

Chairman and Ranking Minority Member of the Following Congressional Committees and Subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Governmental Operations
House Subcommittee on Legislation and National Security, Committee on Government Operations

Part IV - Management Comments

Office of the Under Secretary of Defense for Acquisition
Department of the Army
Department of the Air Force

Office of the Under Secretary of Defense for Acquisition Comments

ACQUISITION

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3000

16 AUG 1993

MEMORANDUM FOR DIRECTOR, ACQUISITION MANAGEMENT
DIRECTORATE, OFFICE OF THE DOD INSPECTOR GENERAL

SUBJECT: Draft DoD Inspector General Audit Report on the Low-Rate Initial Production in Major Defense Acquisition Programs (Project No. 2AE-0026)

Thank you for the opportunity to review the draft audit report concerning low-rate initial production (LRIP).

In general, we are supportive of your findings and recommendations, but would note that in our view most of the problems noted in your report are due to poor compliance with current LRIP policy -- not the policy itself. For example, the LRIP problems in the C-17 and ASPJ programs were not as much a shortcoming in LRIP policy as they were a failure to take heed of warning signs. On page 31 of your draft report you admit that "Often, the programs had entirely adequate acquisition strategies approved, which established appropriate prerequisites for low-rate production decisions, but the acquisition strategies were either changed or not adhered to before the low-rate production decision". Most of the reasons that program plans are not adhered to are related to unforeseen technical problems or substantial reductions in planned quantities/program funding. Long lead LRIP items are typically contracted for 18-24 months in advance of production and are therefore on contract well before technical, fiscal, or programmatic problems surface. Quite often it costs more to change the contract than to proceed as planned. We agree that expanding the 5000.2 guidance on LRIP standards should help but we cannot see how re-introducing the Milestone IIIA will help much as the eight Milestone IIIAs cited in your draft were apparently ineffectual.

Please be advised that the name change from USD(A) to USD(A&T) that you anticipated in your June 1993 draft report did not occur. The USD(A) remains the official title. We understand that the Air Force is also communicating directly with you regarding factual errors in the report regarding Milstar.

Our detailed responses to individual recommendations are:

FINDING A - Readiness for LRIP

Recommendation 1.a. recommends that DoDI 5000.2 be revised to include a new milestone for MDAPs prior to entry into LRIP (the 5000.2 policy prior to February 1991 included the LRIP

Milestone IIIA). We nonconcur in this recommendation. All eight of the programs (PLS, MK-50, EA-6B, Milstar Terminals, ASPJ, C-17, SFW, and JTIDS) went through an LRIP Milestone IIIA and yet you criticize each program and make this recommendation to re-introduce the Milestone IIIA. It is not clear how the reintroduction of an LRIP Milestone IIIA will be corrective action when all cases reported did include a milestone consideration of LRIP. Our current policy states that for ACAT 1 programs a review may be required prior to LRIP. We resist adding a new milestone, since 5000.2 policy applies to all acquisitions, not just MDAPs. A large majority (near 90%) of all acquisition programs are not major. As DoD increasingly turns to more commercial products, we may cause great confusion for non-major programs that really need no LRIP review (e.g., Chevy Blazers off the commercial production line for Army CUCV use). We feel that our current policy for optional LRIP on MDAPs is appropriate. What is needed is the increased rigor you note in other recommendations, not Milestone IIIA.

Recommendation 1.b. recommends that for MDAPs, 5000.2 be revised to provide increased guidance on LRIP accomplishments regarding operational assessment, design, and production readiness review, and operational test prerequisites. We concur.

Recommendation 1.c. recommends that for MDAPs, 5000.2 be revised to add program specific exit criteria for LRIP. We concur except that the inclusion of the criteria in development contracts should be at discretion of USD(A).

Recommendation 1.d. recommends that for MDAPs, 5000.2 be revised to direct EMD contracts to include production representative models for LRIP. We nonconcur as this is too stringent, and our current Milestone II policy already states that LRIP units are "production configured or representative."

Recommendation 2. recommends a revision to MilStd 499A. We concur.

FINDING B - LRIP Quantities and Commitments

Recommendation 1. recommends revision of 5000.2 to require minimum LRIP quantities for IOT&E, initial production base, and orderly increase to full-rate production. We nonconcur as we feel this is already 5000.2 policy (part 3-19).

Recommendation 2. recommends revision of 5000.2 to include LRIP quantities in PRR guidelines. We concur but feel certification is not necessary.

Recommendation 1. recommends revision of 5000.2 to include cost/benefit analysis, before entry into LRIP, of break in production versus LRIP. We concur.

Recommendation 4. recommends revision of 5000.2 to require SAEs to request program specific waivers before contract award when LRIP requirements are not met. We nonconcur because the other recommendations in Findings A and B above will be adequate corrective action.

For Leland S. Jordan

Gene H. Porter
Director, Acquisition
Program Integration

Department of the Army Comments

Final Report Reference

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

10 AUG 1993

SARD-ZCS

MEMORANDUM FOR Inspector General, Department of Defense (Auditing)

SUBJECT: DoD Inspector General Draft Report, Low-Rate Initial Production in Major Defense Acquisition Programs (Project No. 2AE-0026)

1. Reference Draft Audit Report, Low-Rate Initial Production in Major Defense Acquisition Programs, Project No. 2AE-0026, 17 June 1993.

2. The following information and comments are provided.

3. Page 14, Unresolved Deficiencies. 13

This paragraph describes the Palletized Load System (PLS) entry into LRIP and production award with the less than required 1600 Mean Miles Between Hardware Mission Failures (MMBHMF). Not mentioned are the following considerations that led Army to this decision.

a. Normal RAM growth usually experienced during developmental testing was prevented by test and time constraints. Army was under a Congressionally mandated deadline to make a production contract award.

b. The PLS, while somewhat more complex than a typical truck, does not incorporate high technology. The failures experienced were not unusual for a truck system.

c. Historically, other truck programs have experienced a low initial RAM score and have made dramatic improvements through the initial production phase similar to that needed for the PLS.

d. Additional testing was planned for and conducted shortly after the LRIP decision to assure the needed RAM growth was attained.

e. A competitive contract price would have been lost if delays to the contract award were experienced.

As it is, the better decision was make. RAM requirements were met and the program maintained its overall schedule while still benefitting from a competitive price.

Final Report Reference

SARD-ZCS
SUBJECT: DoD Inspector General Draft Report, Low-Rate Initial Production in Major Defense Acquisition Programs (Project No. 2AE-0026)

17 4. Page 19, Review Performance:

The report states that "No Production Readiness Reviews (PRR) were performed for PLS because PLS was considered a nondevelopmental item (NDI)". We disagree with this statement on two counts:

a. The decision not to have a PRR prior to the Milestone IIIA DAB decision was not based on PLS being an NDI. Our primary reasoning for not pursuing a PRR was that we had gone through two rounds of evaluating production readiness on all PLS competitors during the preceding two-year period (as part of the prototype and production source selections). Most of the major systems entering LRIP have not had any competitive source selection evaluation (including pre-award surveys for a long period because the current process of treating LRIP as an extension of the Engineering, Manufacturing and Development (EMD) Phase usually runs a minimum of two years.

b. The PLS has, in fact, had several PRRs at the contractor's facility since the production contract award to monitor process.

22 5. Page 24, Impact of Present LRIP Process.

No mention was made of the fact that the PLS LRIP quantities are part of the production contract and that the contract is firm fixed price, with the contractor absorbing all costs associated with test deficiencies. This allocation of risk placed on the contractor, was critical in the LRIP approval decision. Since this fact is lacking in the report, the figures and statements made on page 32 regarding PLS LRIP quantities is highly misleading because it implies that costs and risks for corrective actions on the trucks fall on the Army.

57-58 6. Page 53 & 54, Appendix E.

Not certain what is meant by Acquisition Strategy - Not Adhered To and also Controls Not Followed, under Internal Controls, since no reference is cited.

60 7. Page 56, Appendix G.

The PLS line is in error. The PLS LRIP is part of a 5 year multi-year contract with encompassing full-rate production. The LRIP portion as well as annual awards are not separate contracts.

2

Final Report Reference

SARD-ZCS
SUBJECT: DoD Inspector General Draft Report, Low-Rate Initial Production in Major Defense Acquisition Programs (Project No. 2AE-0026)

8. Page 57, Appendix H. 61

The program structure is misrepresented. There was no requirement to specify LRIP quantities at Milestone II, which was held in Mar 1988, LRIP requirement came into effect in the FY90 Defense Authorization Act.

9. POC for this action is Mr. Steve Rann, SFAE-CS-L/SARD-ZCS, 695-8442.

for Dale Pannott
Roy D. Lewis
Colonel, GS
Director for Combat
Service Support

3

Department of the Air Force Comments

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

17 AUG 1993

OFFICE OF THE ASSISTANT SECRETARY

MEMORANDUM FOR ASSISTANT INSPECTOR GENERAL FOR AUDITING
OFFICE OF THE INSPECTOR GENERAL
DEPARTMENT OF DEFENSE

SUBJECT. Draft Audit Report on the Air Force Milstar Terminal Program
(PROJECT NO. 2AE-0026)

We have reviewed the subject report which alleges several major defense acquisition programs entered Low Rate Initial Production (LRIP) without completing prerequisites in design, testing, and preparation for production (Finding A). It also asserts that LRIP acquisition strategies for major defense acquisition programs do not effectively limit production quantities and control program risk before Milestone III, Production Approval (Finding B). We have reviewed the facts on the Milstar Terminal Program and do not concur with the information presented in the report nor with its conclusions.

The information in this draft report is based on the audit results documented in Report No. 93-084, "Air Force Strategic and Tactical Relay Satellite Terminal Program." In our earlier letter, dated 23 March 1993, we provided a detailed response to the issues documented in Report No. 93-084 and are still waiting for the resolution. It is premature to generate a new report that is based, in part, on information that is still being contested, and to cite examples that may not be valid. We request you wait for the resolution before completing the new report. The attached detailed comments reiterate the USAF position, but are arranged to match the organization of the new report

The detailed comments explain that the program met the criteria in the Program Management Directive that were required to demonstrate readiness for LRIP. This criterion included specific measures for verifying terminal performance as well as compatibility with several space systems and other service terminals. The results were reported to the Defense Acquisition Board (DAB) in a 1989 Milestone IIIA review. The DAB concurred that the program was ready to enter into LRIP. Facts continue to support this decision. LRIP functioned as intended by resolving manufacturing issues; providing terminals for Initial Operation Test and Evaluation; and forming the competitive basis for a contract award that lowered terminal unit prices by one half. Additionally, there have been very few Engineering Change Proposals generated since the award of the LRIP contracts demonstrating the stability of the design.

The detailed comments also clearly establish why completing the terminal procurement under the LRIP contract was in the Government's best interest and did not induce excessive risk to the program. This was a major issue for the October 1992 Milstar Restructure DAB. After considerable review of the issue, the Director

of Operational Test and Evaluation and Assistant Secretary of Defense for Production and Logistics staffs, concluded the risk of completing production under the LRIP contract did not warrant the added expense associated with an 18 month delay. This recommendation was conditioned on successful completion of an independent Operational Assessment (OA) and Reliability-Qualification (REL-QUAL) test. Given the completion of the OA, which found no show stoppers, and the successful completion of the CPT REL-QUAL test, the buy-out contract was awarded.

We look forward to resolving your concerns and looking for ways to improve the acquisition process. If there are any further questions, your staff should contact Capt Cox, SAF/AQSS, at extension 33364 or Lt Col Waln, AFPEO/SP, at extension 38056.

DARLEEN A. DRUYUN
Deputy Assistant Secretary
(Acquisition)

ATCH
Detailed Comments

cc: USD(A)
ASD (C3I)
DOT&E
COMPTROLLER
AF/TE
AFPEO/SP
AFOTEC/CV
SMC/MC
ESC/MS
JTPO

Final Report Reference

Detailed Response to Finding A "Readiness for Low-Rate Initial Production"

Major Defense acquisition programs entered LRIP without completing prerequisites in design, testing and preparation for production. Premature entry into LRIP was caused by inadequacies in the milestone review process, regulations, and policy guidance for LRIP. Also, program planning was done when urgency to meet threats justified highly concurrent development and production efforts. As a result, the Government incurred significant program risk from systems entering LRIP when their designs were not stable and the readiness of production processes was not verified

The Milstar Program Management Directive included specific criteria for verifying terminal performance, compatibility with several space systems and other service terminals, and readiness for production. These criteria were met, and results of development progress to date were reported to the DAB at a Milestone IIIA review in May 1989. The DAB determined that the design reviews, developmental and early operational testing, and production readiness reviews had been successfully accomplished as required. As a result, the DAB authorized the Air Force to proceed with LRIP for Milstar Command Post Terminals.

Planning and Preparation for Low-Rate Initial Production

11 Design Problems (see page 12)

The Department of Defense (DoD) Inspector General's (IG's) report states that the Air Force Milstar Terminal Program entered LRIP with an incomplete design. As evidence, the report cites the fact that LRIP contracts were awarded with B level specifications (performance requirements) rather than C level specifications (design drawings).

As determined through the DAB review process, there were no unresolved design issues in May 1989 that would have prevented the start of LRIP. All hardware FCA/PCAs had been accomplished, with closure plans in place for all action items. Design and assembly drawings were available to the LRIP contractors and would be finalized upon closure of PCA action items. Three of four software configuration items were complete; testing of the fourth item was underway. B level specifications were used to award the LRIP contracts because the C level specifications were not finalized until after reliability qualification testing had been completed; as anticipated, this resulted in some drawing updates due to minor design corrections that were easily incorporated into the production baseline. The terminal's detailed design was quite stable at the time of LRIP award.

Additionally the draft IG report states the contractor was still completing design as of November 1992, as evidenced by open product quality deficiencies, which could "result in hazardous conditions for users or prevent performance of strategic or tactical functions."

Product Quality Deficiency Reports (PQDR) are not an accurate measure of design maturity. Only one of the PQDRs initiated in over 18 months of user testing was deemed Category I, affecting the ability of the terminal to perform specific strategic or tactical functions; that problem had already been corrected in the next upgrade of the terminal software at the time of detection. Most of the PQDRs opened to date represent user requested enhancements to the system and are not deficiencies against the terminal system specifications, nor do they represent an incomplete design. Changes of this type are expected to occur continuously as the user gains more experience

operating this complex system. This is not an indicator of design immaturity. Most of the open PQDRs are being resolved by planned software maintenance actions.

The terminal software was purposely designed to be resident in erasable Read Only Memory that is relatively simple to reprogram. The original development strategy recognized the complexity of the system and the need to evolve and tailor the terminal functionality based on user needs. After two block software upgrades, this design has shown its ability to provide those updates without costly impacts on the terminal hardware.

A status review of the open PQDRs (52 were open at the time of the IG team's visit) was held on December 3, 1992, with AFOTEC and using command (AFSPACECOM and ACC) representation. At this review meeting, 10 PQDRs were declared closed. Closure dates were determined for the majority (32) of the remaining open items and will be closed as part of continuous software updates. Further user inputs or action by other organizations are needed to determine closure date for the remaining (10) items. A PQDR is considered closed only after an AFOTEC-witnessed verification event. The actual corrective action in most cases has been completed and incorporated into the terminal design several months before an item is declared closed

The draft IG report also cites development work on the terminal's central processing unit (CPU) to satisfy the capacity margins in the 1992 Operational Requirements Document as further evidence of an incomplete design.

This implication is also incorrect The development work cited in the IG report is for a new version of the terminal's CPU card, meant to be a plug in replacement for the current CPU card. This effort is an enhancement to the current design that may be procured to meet new user needs, and will not go into production until needed. It is not a continuation of the initial design process.

The Milstar Command Post terminal processor margins were not specified in the ORD that was in effect when the terminal was designed. The latest ORD, signed on September 4, 1992, levied new requirements against the terminal six years after the design was initiated. The program office has worked with the operational commands in an iterative process to plan evolutionary upgrades to the terminals and has demonstrated that the margin shortfalls do not affect the operational performance of the terminal. In our discussions with AF T&E prior to the October 1992 DAB Program Review, we clearly demonstrated that adequate margins exist for all known and planned enhancements A retrofit of the CPU card to the newer unit, if an update is desired, is expected to cost approximately $26K per terminal.

Reduced or Limited Testing (see page 15)

The draft IG report cites a GAO report (GAO/NSIAD-90-28), which concluded that the June 1989 decision authorizing the Air Force to proceed into LRIP was based on less test data than originally planned, thus increasing the risk that design changes could occur.

The GAO was correct in that technical problems encountered with the C-18 test aircraft and programmatic problems with PACER LINK (an operational EC-135 aircraft) reduced the availability to support the testing. Nevertheless, all functional and technical performance areas to be evaluated before the LRIP DAB review were tested successfully, and performance met or exceeded specifications. Design verifications against the functional specifications were completed (FCAs). Compatibility with on-orbit AFSATCOM and Single Channel Transponder payloads were demonstrated. Compatibility with the on-orbit FLTSAT EHF Package was demonstrated. Compatibility with the Milstar EHF/UHF payload Engineering Development Verification Model was demonstrated. (These were PMD criteria for LRIP award in 1989.) At the time of the DAB

Final Report Reference

review, functional performance testing, environmental testing, electromagnetic interference testing, and TEMPEST testing had been successfully completed. Flight tests with an airborne terminal aboard the (4950th Test Wing's C-18) had been successfully underway since September 1988. Survivability/vulnerability and reliability growth testing was underway with no major design issues expected to be found (none were). Operational (terminal control) software had received government led verification and validation, with extensive user involvement. In summary, adequate test data was available to support a DAB go-ahead.

Deleted (See 31)

Review Performance (see page 19)

The IG report alleges that the Air Force Milstar Terminals Program Office did not perform annual incremental Production Readiness Reviews during engineering and manufacturing development as required by MIL-STD-1521B.

The IG's assessment of the program and interpretation of the Military Standard is incorrect for the following reasons

a) The program office had conducted two Production Readiness Reviews (PRRs). The first PRR was accomplished during March/April 1988; the second PRR was conducted March 1989. Both reviews were prior to the LRIP DAB review in May 1989. Both reviews were highly successful and showed that production processes were ready to be implemented. Significant features of the Milstar terminal program's transition to production included use of low risk hardware and software technology, use of standard parts, and early use of manufacturing lines to build EDMs As reported to the DAB in May 1989, factory test sets were in place, tooling was on line, manufacturing processes and work instructions were complete, environmental stress screening requirements were established, and critical piece parts/vendors/hardness items were identified

b) Also, prior to the award of the LRIP contracts, during the Full Scale Engineering Development contract, the program office conducted Manufacturing Assessment Reviews (MARs) and Leader/Follower meetings bimonthly. The MARs provided the program office nearly continuous visibility into the contractor's production abilities. The leader/follower meetings were critical to assure transfer of product and process technology between the two potential production contractors

c) Lastly, current LRIP status shows both Raytheon and Rockwell are achieving the contract schedule and are anticipating early delivery of the remaining LRIP quantity. This is the most credible demonstration that production readiness had been achieved prior to the award of the LRIP contracts. Raytheon is projecting a $20M cost underrun , while Rockwell is anticipating a $10M underrun. The Government can mitigate risk to insure production readiness through the use of PRRs, MARs, and regulations but there is no substitute for actual delivery of hardware.

19

Engineering Development Models (see page 21)

The IG report states that Milstar terminal EDMs available for testing before the June 1989 LRIP decision were not fully mature in design. Contractor schedule documentation relating to the EMD contract showed that deliveries of final versions of the development models did not begin until 1991.

Formal performance and qualification testing was completed, before the LRIP decision, on hardware that included all design fixes identified through the development and testing process. Test data was generated, in general, from the Full Scale Engineering Development model terminals

Final Report Reference

that included these fixes Over 4000 hours of terminal, terminal-to-payload, and terminal-to-terminal testing had been successfully accomplished. All user functionality requirements had been provided and the terminal's communications performance met or exceeded specification requirements. Box level reliability testing showed reliability many times higher than AFSATCOM terminals

The final versions of the EDMs mentioned in the IG report refer to deliveries against a contract line item intended to incorporate all the design fixes identified through testing into hardware that would be fully production representative. The contractor has modified these terminals so that they support all the functionality present in actual production systems. These "final version" EDM terminals are being used to support early operational testing on aircraft and pre-launch intersegment testing with the Milstar satellite and control elements. They will also be used, along with LRIP terminals, to support IOT&E following the first Milstar satellite's launch.

Entry into Low-Rate Initial Production

Acquisition Planning (see page 23) 22

The IG report criticizes the decision to grant LRIP authority for Milstar terminals because the urgency of providing jam-resistant, nuclear-survivable communications service was a significant factor in the decision, despite the terminal design being incomplete.

This implication is false Specific Program Management Directive (PMD) criteria (what would now be called exit criteria) had been established to ensure development had progressed to the point when initial production could start These criteria were 1) design verification against the Milstar Air Force Terminal System Specification, 2) compatibility with AFSATCOM and Single Channel Transponder Payloads, 3) compatibility with the FLTSAT EHF Package, 4) compatibility with the Milstar EHF/UHF payload, 5) comprehensive logistics planning for organic support, and 6) coordination of AFSC/AFLC/AFCC planning for terminal installations. As shown above (under "Design Problems"), the design of the terminal was not incomplete at the time of the DAB review in May 1989. Overwhelming evidence that the PMD criteria had been met was presented by the Program Office to the DAB. The DAB determined that the Program Office had indeed met the PMD criteria to allow entry into the LRIP phase of the program. The fact that deployment of LRIP terminals would satisfy urgent national needs for jam-resistant, survivable communications may have been a factor in the DAB decision and as such is an appropriate business consideration for the DAB; however, the DAB still determined that the Milstar terminal program had met critical developmental milestones as well

Impact of Present LRIP Process

Use of Funds (see pages 25-26) 23–24

The IG report states that the Air Force did not provide adequate oversight or control over the expenditures of RDT&E and procurement appropriations on the Milstar terminal LRIP contracts for the terminals. As a result, violations of United States Code, title 31, section 1301 occurred, which requires that appropriations be applied only of those purposes for which the appropriations were made.

The Air Force has reviewed this issue, as requested by the DoD IG, and determined that there is no basis for believing that an Antideficiency Act violation occurred. The review covered progress payment liquidation against deliveries and concluded that no progress payments were

made for any type of cost in excess of the appropriations available to pay such cost. The Contract Line Item Number (CLIN) structure of the contract contains discrete line items which are associated with each separate type of appropriation. Further, the contract requires that incurred costs be segregated by appropriation. This is accomplished through the Contract Funding Status Report (CFSR). Funds for each appropriation have been obligated to cover funding liability at the ceiling price of each funded CLIN. Therefore, there are sufficient funds available for payment of the contractor's incurred costs under each CLIN. Accordingly, the Antideficiency Act was not violated.

We are aware of the resolution to a disputed recommendation in OIG Audit Report No. 92-064, "Titan IV Program," dated March 23, 1992. We understand that in accordance with that resolution, OSD plans to require that contractor's requests for payment must identify amounts by contract line items or subline items to the disbursing officer. When such new contractor guidelines are required by governing directives, the Air Force will apply them to the Milstar progress payments

Final Report Reference

Detailed Response to Finding B "Low-Rate Initial Production Quantities and Commitments"

The LRIP acquisition strategies for major Defense acquisition programs did not effectively limit production quantities and control program risk before Milestone III, Production Approval. Deficiencies in planning and executing the transition from LRIP to full-rate production were identified. LRIP acquisition strategies were not effective because production decisions were scheduled before system design had stabilized. LRIP procurement contracts were awarded while efforts to stabilize the design and production process took place. While the establishment of exit criteria for planned production decisions was required starting in 1991, exit criteria were not effectively used to control low-rate production commitments. As a result, the Government incurred the excessive program risk of over-commitment to production of systems that have not proven their production readiness or technical operational suitability and that may have serious deficiencies that may be difficult and costly to fix in production.

The Milstar Terminal Program Office does not concur with this finding. The Program Management Directive included specific criteria for verifying terminal performance, compatibility with several space systems and other service terminals, and readiness for production. These criteria were met and results reported to the DAB at a Milestone IIIA review in May 1989. The Government did not incur excessive program risk by allowing the Milstar terminal program to enter into LRIP. Rather, LRIP functioned as intended to weed out manufacturing issues, provide terminals for IOT&E, and form the basis for an effective competition for the buyout contract award that lowered terminal unit prices by one half. Additionally, there have been a minimal number of hardware ECPs generated since the award of the LRIP contracts. The problems being fixed by these ECPs were uncovered during highly instrumented initial factory acceptance testing and probably would not have been discovered by additional field testing.

Planning for Low-Rate Production

Variance in Planned Low-Rate Initial Production Quantities (see pages 32-33)

34-35

*The IG report criticizes the decision to not rescind the June 1990 extension of LRIP authority to 136 terminals despite 1992 DoD reductions in the terminal program that reduced the total terminal quantity planned from 988 (in June 1990) to * . In effect, award of the "buy out" contract would be a production decision prior to IOT&E completion.*

Based on a total production run of approximately 1000 terminals, LRIP was approved in June 1989 for the Milstar Command Post Terminals (CPTs) and extended by USD(A) in June 1990 for a total LRIP quantity of 136 terminals. Once LRIP production began, Congress directed a Milstar restructure emphasizing tactical military requirements. As a result, the total production quantity of CPTs has been reduced to 81 terminals (43 CPTs are on contract and a CPT buy-out contract procuring the remaining 38 CPTs was awarded in May 93).

This report implies that since the planned buy-out contract award will complete the procurement of CPTs prior to Operational Test and Evaluation (OT&E) (a condition brought on by the Congressionally directed Milstar restructure), the buy-out should have been delayed. This fact was raised as a major issue and thoroughly reviewed by the Office of the Secretary of Defense (OSD) staff in preparation for the October 1992 Milstar Restructure Defense Acquisition Board (DAB).

*Predecisional data removed.

The OSD staff determined that the buy-out award should proceed after completion of reliability qualification testing and an independant Operational Assessment (OA). The readiness of the terminal for this final production was explicitly considered by the OSD staff in preparation for the DAB The Director of Operational Test and Evaluation (DOT&E) staff reviewed the program in May 92 and requested AFOTEC conduct the OA of the CPT. The OA was required to "address all terminal Test and Evaluation Master Plan (TEMP) OT&E objectives and identify any 'show-stoppers' which would impact successful completion of the AF CPT buy-out." While there were several issues raised, AFOTEC concluded there were no "show stoppers" in meeting all threshold requirements. The issues raised in the OA have been addressed and were considered by the OSD staff in preparation for the October 1992 DAB. The decision of AF/TE and the OSD staff was the cost of a delay in the program ($144M) far outweighed the small risk of delaying the buy-out until OT&E could be accomplished. The DAB therefore approved the award of contracts to procure the remaining terminals Because of the reduction in quantity, the remaining 38 terminals could not be construed as a full rate production effort and certainly could not justify the cost of a break in production to wait for a satellite IOT&E.

Page 7

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